RADIO

ESTABLISHED 1917

THE STORY OF KD4GYM--SWAN ISLAND

•

TWO-FREQUENCY-STUB FEEDER MATCHING

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U. H. F. PORTABLE - MOBILE EQUIPMENT

Technical Radio and Electronics

★

July 1941

NUMBER 261

30c IN U.S.A.

RADIO
the worldwide authority . . .

Published by EDITORS and ENGINEERS, Ltd.

Home offices: 1300 Kenwood Road, Santa Barbara, California

Telephone: Santa Barbara 4242
Bell System teletype: S BAR 7390
Cables: EDITORSLTD SANTABARBARACALIF

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ARTICLES

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DEPARTMENTS

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Past • Present and • Prophetic

10-20 Beam

If you are wondering what to do with that ten-meter close-spaced beam now that ten seems to be in such dire straits, Valentine has the answer on page 39. He simply converts the beam into a three-element "droop" beam for 20 meters. The conversion is done in such a way that changing bands with the antenna is not greatly more difficult than changing bands in the transmitter.

Stub Matching

And speaking of changing bands with the antenna, on page 36 we have the answer to matching feeders on more than one frequency. The system deserves—and probably will have—wide use in amateur work. There are no relays and no switches, just two stubs cut to the right length and located at the proper points. The two frequencies don't even have to be in harmonic relationship for this system to work, which is another reason why we feel it will find wide application.

Parenthetically, it might be added that if the "second" stub (see article) is quite short, so that when built out to a quarter wave at the "first" frequency the distance between the feed line and the shorting bar is a small proportion of the total "built-out" length, trouble from extremely high voltage at the open ends of the stub is likely to occur in high-power installations. The remedy is to change the "first" stub from a closed to an open type or vice versa and repeat the tuning procedure, the object being to make the necessary length of the "second" stub—before it is built out—as close as possible to a quarter wave at the first frequency. This consideration is something that didn't show up in low-power tests, but has proven troublesome in tests with higher power. Fortunately, the situation is easily rectified by the method described above.

F.M. on Ten?

We note with interest the A.R.R.L. Board's action in voting to request the F.C.C. to open part of the ten-meter band to f.m. transmission. The desirability of such an action has been mentioned here several times, as you may remember. One of the things that has somewhat deterred us from going full-out on the ten-meter f.m. question is the problem of adequate enforcement of restrictions on the deviation. The simplest solution would seem to be to require that the transmitter be inherently incapable of exceeding a certain set deviation, and we have several ideas along this line at present under test in the lab. One of these should provide the answer, and if so, it will appear in the first Fall issue. Should the A.R.R.L.'s request be granted, we can only hope that amateurs will do their utmost to abide by whatever regulations are placed on f.m., until such time as fool-proof transmitter design is available.

Again—The Audio Oscillator

Editor Dawley's much-discussed audio oscillator comes in for further treatment and simplification in an article by Davis on page 40. Davis' version uses a pair of ganged potentiometers as the variable element, in place of the original variable condenser. While it has the disadvantage that resetting it exactly to frequency might not be as simple as in the original unit, since the full audio range is compressed into one dial rotation, the new version shows how high-quality audio can be obtained over a wide range of frequencies and at low cost.

Police Ideas

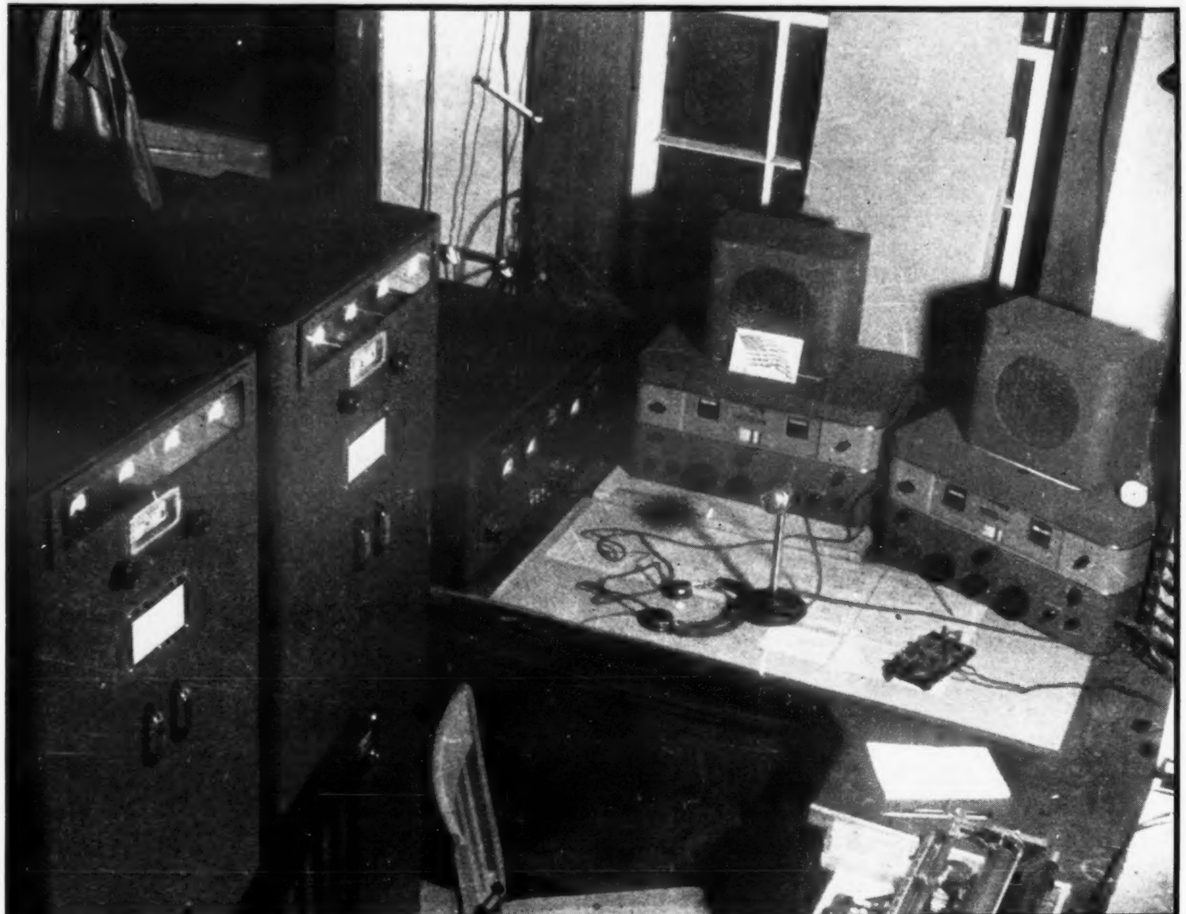
We've covered high-power and medium-power police transmitters in previous issues, and this time we present a low-power outfit. Shannon's rig is just the thing for small towns using two or three patrol cars, and amateurs living in such municipalities are the logical ones to build and install the radio equipment. See page 26.

Further in the police radio line we present an article containing some ideas on intercommunicating between cars via the station transmitter. Ives tells the advantages of such an arrangement in his articles, which begins on page 34.

Tale with a Moral

When this issue with the story of KD4GYM firmly in place on page 9 finally rolls off the presses, Steve Paull, the story's author, and the whole staff will heave a sigh of relief. For behind the story there lies a tale. It all started when Paull was still on Swan Island. X-DX editor Becker contacted KD4GYM several times and, after some prodding, got a promise of the story. After returning to Milwaukee, Paull wrote the story and sent it to Becker in Los Angeles. Becker happened to be in San Francisco at the moment, however, so the manuscript was shipped north, where it finally

[*Continued on Page 95*]



The operating position at KD4GYM. The two tall rigs to the left are c.w. transmitters for Navy schedules. Next, on the operating table, is the 100-watt HT-9 transmitter which was used on 14-Mc. phone. The two receivers (AR-77's) are on the operating table along with the phones, mike, bug, and the mill.

The Story of

KD4GYM

By STEVE PAULL,* KD4GYM (W9FPF)

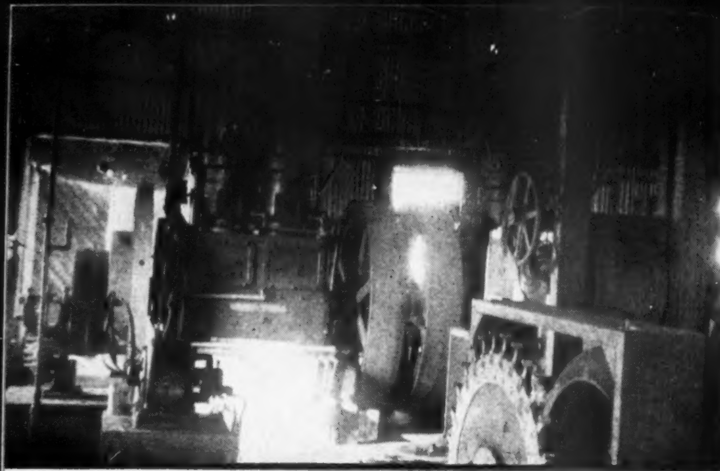
After operating KD4GYM on Swan Island, West Indies, for five months I find that even now very little is known about the island, the ham station, and operating conditions there in general. In fact, it seems there are many false notions and wild impressions prevalent about the place. It is with the hope of giving a more accurate picture of the layout that this brief description and life history of KD4GYM is presented.

Swan Island is a small coral island situated in the Western Caribbean Sea, latitude 17 degrees 22 minutes north, and longitude 83 degrees 57 minutes west. Most fellows worked had some difficulty in locating us on the map. None but the most detailed maps will show the island as it is only about two miles long and about a half mile wide. The highest point on the island is some fifty feet above the sea. A good portion is covered by a coconut grove of about eight thousand trees. The rest of the island is wooded with a variety of trees and underbrush. Most of the shoreline is of sharp coral rocks and cliffs. Several sand beaches are found on all sides of the island.

The island is inhabited by some twenty-five West Indian natives. Mr. Donald Glidden, caretaker of the United Fruit Co. premises, employs them for this work. They also harvest coconuts for selling to ships calling at the island. Many interesting stories about the history of the island are told, ranging all the way back to the days of old Captain Swan, buccaneer, after whom the island was named. And how can we forget the iguanas, rats, and lizards? The iguanas are all over the island, and being vegetarians, make their ugly appearance in gardens and coconut trees feeding on plants and coconut blossoms. Rats make their appearance known at night by mysterious noises which were usually attributed to "Captain Swan's ghost." The lizards are the best friends of the animal kingdom. Realizing that they are largely responsible for reducing the insect and mosquito populations, we didn't mind at all if occasionally one of these comical little creatures was found perched on the microphone or typewriter. They are so very curious that I had a mind to teach one of them the code and let him do my CQing for me on c.w.

The story of KD4GYM begins in the summer of 1940 when the Weather Bureau station was to be reopened on Swan Island. The task was assigned to three observers, Harold Crutcher, "Crutch," of Atlanta, Ga., George Barnes of Seattle, Wash., ex-Signal Corps op-

*335 Carrie Street, Sault Ste. Marie, Michigan.



● **Relics of another day: Some of the power supply equipment of World War I spark station "US" found on the island.**

erator, and myself, ex-W9FPF. Stopping over in Washington, D.C., en route afforded an excellent chance to apply to the F.C.C. personally for transfer of my ham ticket to the new location. Believe me, the office personnel in the amateur section of the F.C.C. give the hams all possible consideration. Very splendid service was rendered in an effort to affect the transfer as soon as possible. It was not possible to issue the license before the date of our departure, but we did leave for Swan Island reasonably assured that a license would be forthcoming.

August seventeenth found our group of three Weather Bureau men and a cook sailing out of New Orleans on a small freighter bound for Swan Island. Arrival on the twenty-first afforded a first glimpse of the future QTH. Back from the rocky shore could be seen the groves of coconut palms, and standing against the sky loomed the two stunted radio towers formerly used by the spark station, call letters US, back in the old spark days. Originally this station had four of these 250-foot towers laid out in a large rectangle. Badly weakened by corrosion, two of these towers had been cut down and the remaining two cut off to a height of 100 feet in an effort to minimize the danger of falling in a high wind or hurricane.

Supplies and equipment, some eight tons in all, had to be taken ashore in a small boat. Some concern was felt as our 800-pound refrigerator, our two power plants, and other heavy units were loaded into the small sailing lighter. But with the boat in command of Mr. Glidden, no concern need have been felt. With the skill of the experienced seaman, everything was landed safely, and by nightfall safely under shelter.

The buildings, formerly used by the old radio station, are all constructed of steel framework covered with corrugated iron. All are fitted with rain gutters on the roofs feeding rain water into reservoirs; rain water and what water can be obtained aboard ship furnish the only water supply on the island.

Work was immediately started on the task of installing the two power plants. They were set up in the old engine house, one near the old Fairbanks-Morse engines, the other directly in front of an old rotary spark gap and beneath a large inductance mounted aloft. What better contrast could one wish for to show a quarter century of progress in radio? The radio station of the past was powered by an internal combustion four-cylinder engine towering some ten feet above the floor, with large compressed air tanks required to spin it and its six-foot fly wheels in starting. Large belt driven a.c. generators supplied the "soup," and a big switchboard with heavy switches and a multitude of meters distributed it to the rotary spark gaps, banks of condensers, and big inductances which comprised the two transmitters. In the midst of this giant paraphernalia we installed our two power plants to supply our equipment: two cylinder gasoline engines directly driving their 3-k.w. 110-volt a.c. generators, and supplied with battery operated automatic starting devices. Measuring only about four feet above the floor, they seemed almost lost in this building of heavy machinery.

Ham radio was forgotten for the time being in favor of work which was immediately necessary. The anemometer had to be placed atop a fifty-foot tower and wired up. Uncrating of equipment also required much of our time. Working out in that late August sun was a new experience, especially for one accustomed to the climate of northern United States. But fortunately enough precautions were taken and no cases of sunstroke resulted. After the power line from the plants to the office was completed, and after the lights were installed, the

next thing to tackle was the antenna system. In a short time one antenna for working on our Navy channel was constructed. This antenna was a half-wave flat top cut for one of our three assigned frequencies, fed by a 600-ohm line and a delta matching system.

The Hallicrafters HT-9 was uncrated August 26, and contact with the Navy station at Balboa, Panama, was made that same day, just five days after landing on Swan Island. That "cast-away" feeling we had felt ever since we grimly watched the little freighter weigh anchor on the 21st was forgotten as we realized now that as long as we could keep our sky wire radiating we were no longer out of touch with the world. The total radio layout at that date consisted of the HT-9 and one AR-77 receiver. More radio equipment was expected to be received at a later date.

Work of establishing the weather station and setting up equipment occupied most of our time during September. Aside from this, ham radio could not be considered until it was certain that a license was granted by the F.C.C. When this word finally came no time was lost in beginning work on the ham antennas. Two of the old steel towers served to support a half-wave flat top for 14 Mc. fed by a 600-ohm line and a delta matching system. The towers were not located favorably for pointing any kind of a beam at the States and poles had to be erected for this purpose. With willing help from the natives we soon had a one wavelength "V" beam pointing north. No antennas for other bands were considered, as we were not equipped to operate the HT-9 on any but the 14-Mc. band.

Some may wonder why a longer beam was not built, or why more antennas were not tried. Plenty of space was available. But part of the work at Swan Island consists of releasing radio equipped sounding balloons at night. Too many antennas make it difficult to avoid fouling the balloon and its attached equipment, especially if a wind is blowing.

More equipment for use on Navy channels was received in November. This consisted of two 150-watt c.w. transmitters. These transmitters were not used on the amateur frequencies, but inasmuch as they are a part of the radio layout they deserve mention here. A considerable portion of our "spare" time was used up installing these two rigs, and in constructing two antennas fed by concentric transmission line. One more AR-77 receiver completes the description of the radio installation.

On September 7 we made our first ham contact on 14-Mc. 'phone with W9HPM. Being new on the air, most of the QSO's were spent in answering the many questions fired at us by the 20 meter gang. . . .

"No, we don't have airmail service here. In fact, we have mail only once in six or eight weeks whenever a banana freighter calls here."

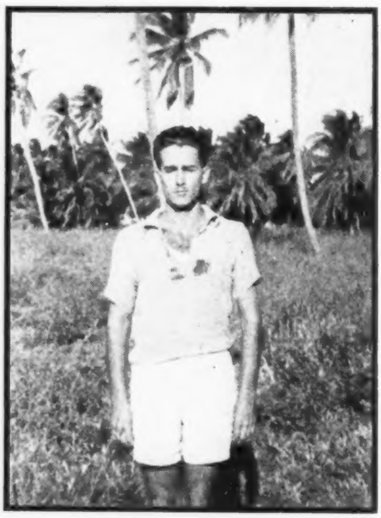
Living quarters of the Weather Station staff and of some of the United Fruit Co. employees.

The sailing lighter in which supplies for the camp were taken ashore from visiting ships.

"No, it is of no use to send us letters special delivery." "Yes, you may send your QSL to us in care of the U. S. Weather Bureau, Swan Island, West Indies, via New Orleans." "Yes, we do intend to return QSL's, but our isolation will have considerable effect upon the promptness, or rather lack of promptness in our doing so." "No, there are no other stations on the island." "Yes, we are considered a new country in working DX."

One question frequently asked was: "What do you do for recreation and entertainment, besides ham radio?" The work at the station left little time for anything else. But when time was available, swimming was found very enjoyable in the warm waters of the Caribbean, although the possibility of an appearance of a barracuda was an ever present worry.

Fishing always brought results. In fact, one hardly needed to go out in a boat to make a catch. One day when the minnows were thick near the shore, a large fish engaged in gorging himself was washed up on the beach by a breaker and left there vainly struggling to get back into the sea. That night the station personnel feasted on the unfortunate victim. Upon relating this story to W3IUU that evening, and after first telling him how I had answered a "bootleg" station using his call, he sadly remarked that these stories were too much for him, and that the tropics were affecting the wiring in my brain or something to that effect.



Steve Paull, KD4GYM, shown just after the removal of his facial foliage for the return trip to the mainland of the U. S.

Razors were packed away on the day of our arrival, and had we been operating a television station our QSO's would have afforded no little amount of entertainment. Undoubtedly the gang would have wondered if they weren't in contact with a station operated by a bunch of derelict beachcombers. Barnes would have had a hard time convincing the gang that he didn't use our soldering iron as a curling iron to get those waves in his well groomed beard. And many a time when the fast clipping c.w. emanating from our antennas suddenly reverted to the characteristic lousy sending which marks the fist of a good many commercial operators forced to the hand key, the operator at the other end would have seen a bearded operator fiercely endeavoring to disentangle his beard from the bug. More cannot be said of our facial foliage without further danger of similar lamentations from W3IUU as to the condition of our brain circuits.

No particular difficulty was encountered with the radio equipment itself. High humidity and salt spray in the air have a tendency to cause excessive corrosion of metal parts. This was carefully guarded against by frequent inspection of equipment and tools, and application of rust preventives. On two occasions sudden changes from dry to rainy weather caused the antenna halyards to shrink and snap. Barring possible occurrence of a hurricane, the winds are seldom high enough to cause any concern for the antennas.

When the 'phone band was open, conditions on Swan Island could best be described simply by "QRM." Skip seemed to be just right for the whole eastern half of the U.S. to pound in with strong signals all at once. There was seldom a time when any station had an undisputed clear channel. The hour or so immediately preceding the band's opening up in the morning was the only time of day when the above conditions did not prevail. Contacts with sixth and seventh district 'phones were scarce although these districts came in consistently good on the c.w. band, especially those stations worked on schedules. The time of day for operating on amateur bands was determined by radio conditions as well as working schedules. Early in the fall the 14-Mc. band was consistently open at night and considerable operating was done between the hours of 8 p.m. and midnight, e.s.t. When the band began to get erratic during these hours, work and sleeping schedules were rearranged so that more operating could be done during the more favorable daylight hours.

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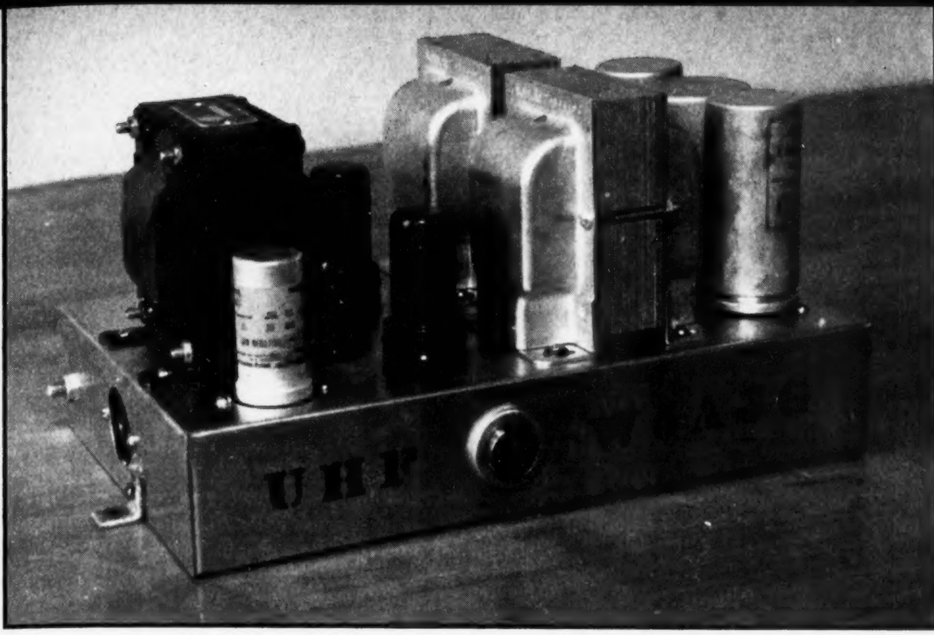


Top view of the completed power supply unit. From left to right the components are: filter choke and filter condenser, the two rectifier tubes, the two power transformers, the vibrators and, between them, the relay. The receptacle on the chassis is connected in parallel with the one in front at the control panel and is used for tuning up from the rear of the car.

Just Another PORTABLE MOBILE

By LEROY W. MAY, JR.* W5AJG

Texas—summertime: sunshine, green grass, and as always uppermost in my mind, good old 56-Mc. dx activity. Loafing around the house in shirt sleeves, long cool ones—but wait! Here's a communication. What? Now she can't do this to me, no sir:

INTERHOUSEHOLD CORRESPONDENCE
TO: W5AJG (OM)
FROM: W5JKM (XYL)

Sir: Please be advised there will be no such loafing this summer. The Jr. Op. and I are going to get Vitamine "D" every day. Not only that, but there will be a full fledged vacation, and furthermore—*you* are going to be the chauffeur. Is this clear?

Respectfully (?),
W5JKM.

Was afraid of that. Now if I had a mobile five ——. Yes, perhaps the little woman does need more recreation, and I could stand to improve my 56-Mc. house pallor to boot. Better not give in too easily, however. Here, Son, take a letter in rebuttal.

INTERHOUSEHOLD CORRESPONDENCE
To: W5JKM
FROM: W5AJG

Yes, dear.

Lovingly,
W5AJG.

The next step need not be mentioned: magazines, catalogues, junk box inspection and all that is associated with that "in-between" stage of wanting on one hand and doing something about it on the other. Suffice to say, in painfully short order I found that a complete mobile installation will include the following equipments:

1. Transmitter and modulator unit (usually combined)

*R4, 9428 Hobart Street, Dallas, Texas.

2. Power supply unit
3. Antenna
4. Control head
5. Microphone
6. Interconnecting cables

Transmitter and Modulator Unit

Lots and lots of excellent material has appeared in past issues of RADIO and the RADIO HANDBOOK on the r.f. section of mobile transmitters. Since this unit should present no difficulty, nothing original or particularly new is set forth here.

One along the lines of the 25-watt Dawson transmitter[1] should serve very nicely. And I will vouch for the common ground return system as set forth in his article. It has been used here for about five years and will certainly go a long way in straightening out u.h.f. transmitters. A few minor changes were made in the circuit, chief among them being that the screen as well as the plate is being modulated in the final r.f. stage.

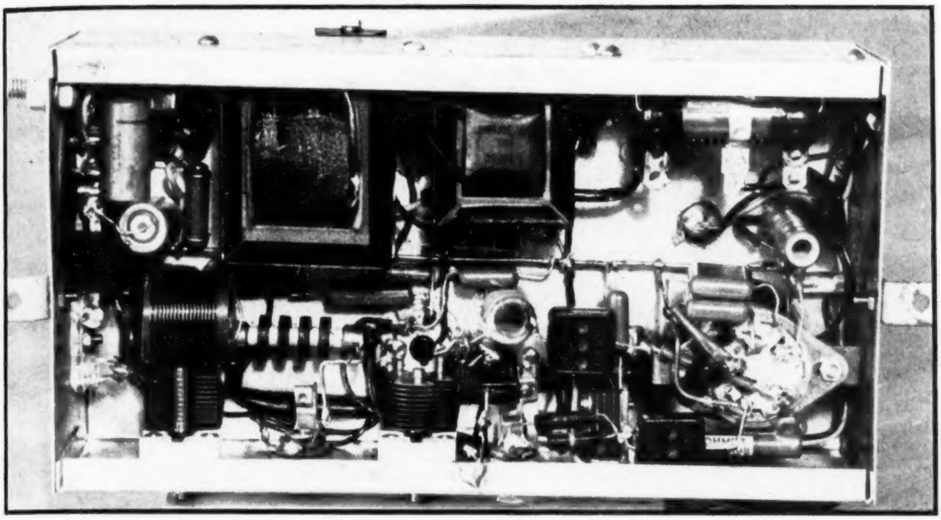
The r.f. and modulator are combined on a single chassis which measures 2.5″ x 9.5″ x 5″. A 6V6G regenerative oscillator is employed using a 40-meter crystal and having output on 20 meters. This drives a second 6V6G as a doubler to 10 meters, which in turn excites the 807 doubler-final to 5 meters. The speech amplifier is a 6N7G triode-connected working into a 6N7G class B modulator, which is fully capable of 100 per cent modulating the 25 watts input to the 807 from a microphone of the single-button variety.

The midget tuning condensers are of the type permitting mounting on a metal chassis. They are tuned by means of a screw driver. All d.c. supply circuits are brought to jacks, so as to allow a milliammeter to be plugged in for tuning purposes.

All values for the various components are shown under the schematic diagram. No

[1]Dawson, "25 Watts on 56 Mc.," RADIO, March 1941, p33.

Front view of the complete transmitter r.f. and audio section. Tubes across the front are, from left to right: 807 final amplifier, 6V6G doubler and 6V6G crystal oscillator. The 6N7G speech amplifier and modulator tubes are at the rear with their associated transformers. The coaxial line to the antenna tuning network may be seen at the left front corner of the chassis.



Bottom view of the transmitter and modulator unit. While there is not a great deal of extra space underneath the chassis crowding has been kept to a minimum around the r.f. tank circuits. The large transformer at the rear is a microphone input transformer, while the smaller transformer serves as the microphone filter choke. Note the common ground bus running down the center of the chassis.

further reading time will be taken other than to suggest that the above mentioned article be consulted on debugging of a u.h.f transmitter by the "common ground return" system.

Power Supply Unit

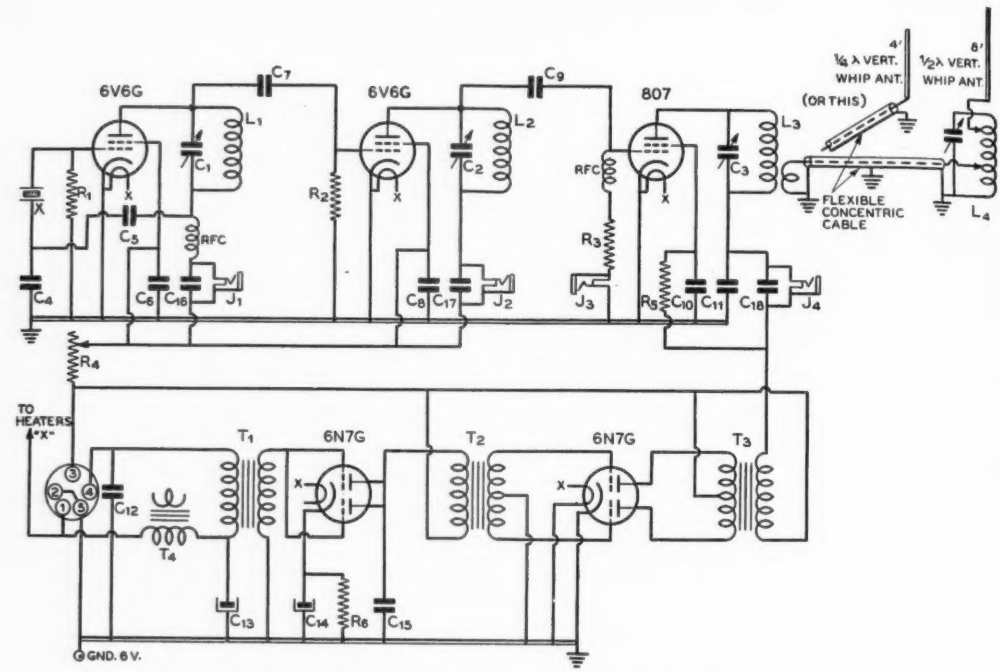
In a mobile rig, the power supply unit is usually the biggest nut to crack. Genemotors are much too costly and are not well adaptable to ham use. If accidentally overloaded, repairs are clumsy and expensive. This leaves the vibrator type of supply, a type which is very efficient and yet very reasonable in cost. Of course ready-made vibrator packs are available but the average shack contains a goodly portion of the materials necessary to construct one. Since I make my living associating with police two-way systems, why not take a cue from one of the nationally known sets and design one along the same lines? So, by discarding all the fancy gadgets, chrome strip, crackle paint, etc., a really fine supply putting out 350 volts at 250 mills can be whipped up, and one which will really "take it" in mobile use.

It is so designed that relatively inexpensive components may be used. Also, should one-half of it become disabled, the unit may still be operated with reduced output. The chassis measures 7″ x 11″ x 2″ and is really two separate vibrator supplies connected in parallel and feeding a common filter system. The pertinent values are shown under the schematic and should be followed rather closely to insure the high output current and voltage. The connections that are shown in heavy lines should be of wire not smaller than No. 14.

A relay is incorporated in the power supply unit which will enable a small control wire to turn on and off the plate supply from the "push to talk" microphone, without having to bring additional leads to the front of the car again.

Maximum power consumption when "on the air" is approximately 18 amperes from a 6-volt battery. Filaments alone consume 3.4 amperes in the standby position. Some further improvement could be made in equipping the transmitter with instant heating tubes, thus reducing the standby drain, but the tubes used in the rig being described are often available or can be borrowed from that 160-meter rig for the summer months.

As most car batteries are located in the front of the car, and the transmitter and power supply in the rear, it is most imperative that large wire be used from the battery to the equipment to avoid drop in voltage. These main battery feeders should not, under any circumstances, be smaller wire than No. 10. A single 25-ampere household type screw fuse and socket is installed as close to the battery as is practicable. This type fuse and socket is much superior to the small and flimsily constructed auto type fuse and holder. Often, a loss of 0.5 to 0.75



R. F. and Modulator Section Wiring Diagram

C_1, C_2—50-μμfd. midget variable
C_3—25-μμfd. midget, double spaced
C_4—.0002-μfd. mica
C_5, C_6—.001-μfd. mica
C_7—.0001-μfd. mica
C_8—.001-μfd. mica
C_9—.0001-μfd. mica
C_{10}, C_{11}—.001-μfd. mica
C_{12}—.01-μfd. 200-volt tubular
C_{13}—30-μfd., 10-volt electrolytic
C_{14}—10-μfd. 25-volt electrolytic
C_{15}—.005-μfd. 1000-volt mica
C_{16}, C_{17}, C_{18}—.001-μfd mica
R_1—100,000 ohms, ½ watt
R_2—100,000 ohms, 3 watts
R_3—25,000 ohms, 3 watts
R_4—10,000 ohms, 50 watts, with slider
R_5—10,000 ohms, 1 watt
R_6—1000 ohms, 1 watt
J_1, J_2, J_3, J_4—Circuit-closing jack
RFC—2½-mhy., 125-ma.
L_1—16 turns of no. 18 enam. wire close-wound on a 1" form.
L_2—13 turns of no. 14 enam. wire close-wound, ½" in diameter, self supporting.
L_3, L_4—5 turns of no. 14 enam. wire spaced to a length of 1", ¾" in diameter, self-supporting. L_4 tuned by 25-μμfd. midget.
T_1—S.b. microphone to grid transformer.
T_2—Driver transformer
T_3—Modulation transformer, 10-watt rating

volt in battery voltage as measured at the equipment is traced to poor contact and heated lugs on these small fuse and holder combinations.

A tip to those looking for vibrators: Any service shop dealing in the repair of car radios will yield a handful of "defective" units, a quite high percentage of which have only a broken lead inside the can, due to vibration. Melt the solder and slip the unit from the can. Such trouble as the above is immediately apparent to the eye and is easily repaired. These repaired units will give excellent service.

Antenna

Although most commercial installations use a quarter-wave antenna on police frequencies, amateurs usually find a full half-wave on 56 Mc. to be superior on mobile installations. Most any type of telescoping receiving antenna capable of extending out to 96" or so will be found satisfactory. Each experimenter probably has his pet way of feeding and of course there are several methods from which to choose. This particular installation consists of a tuned circuit located at the base of the antenna, resonating on 56 Mc., which is link coupled to the final tank coil with flexible co-axial 36-ohm transmission line, the outer shield of which is grounded. If it is desired to use a quarter-wave antenna on the car, the inner conductor of the coaxial line may be connected to the base of the antenna and the shield grounded to the car body, dispensing with the tuned circuit associated with the half-wave antenna. Type of car and contour of metal influence greatly the results obtained with antennas of different types. Every car is a particular problem, and, needless to say, time spent on antenna experimentation produces tremendous dividends.

For tuning, an ideal instrument is an r.f. Thermogalvanometer clipped across a portion

of the antenna at a current loop. This meter will immediately indicate improvement in adjustments. If no such instrument is available, a 6.3-volt pilot lamp with six-inch leads terminated in pee-wee clips may be substituted. A 32-volt 15-watt Mazda globe may be employed as a dummy antenna to load the transmitter to give a rough approximation of power output. With 25 watts input, the output will illuminate the 15 watt bulb to very nearly full brilliancy. Full modulation is easily obtainable from the 807 doubler-final. A prolonged whistle into the microphone will burn the bulb uncomfortably bright.

Control Head

A small box, which is mounted on the instrument panel of the car, containing the filament switch, filament and plate pilot lamps and microphone receptacle, was bent up from thin sheet metal as illustrated in the drawing. Pin type jacks mounted on the back take care of the three control wires. The two heavy battery wires enter through rubber grommets and go directly to the switch.

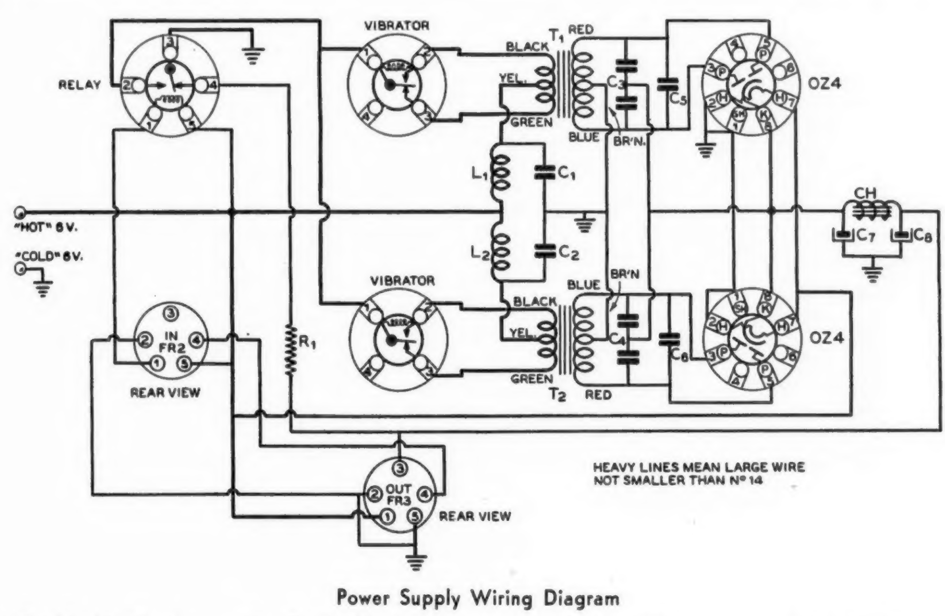
The mike cable plugs into the four-prong receptacle at the rear. This piece of equipment may be finished to blend in with the color of the dash to make a neat installation. Self tapping screws are used to secure it to the car.

Microphone

The microphone in use here is a hand type Shure 9102, single-button carbon and closes two make circuits when the switch is depressed. One set of contacts applies the voltage to energize the unit, while the other completes the circuits to the relay in the power supply unit, putting the carrier on the air. Of course, any single-button carbon microphone possessing two make circuits will operate equally as well. The mike is suspended on a small metal angle when not in use. The illustration shows details of this mounting device on the instrument panel of the car.

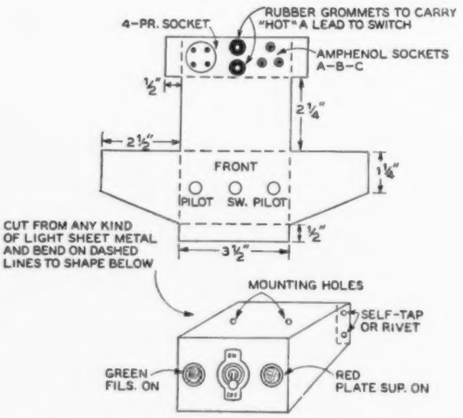
No external battery is needed for microphone excitation. The necessary voltage is developed through the decoupling choke T_4 (transmitter circuit diagram) and is filtered by condenser C_{13} to remove all trace of vibrator hash.

It might be stated here that practically all police two-way installations today use close-talking carbon mikes. This type of microphone is still "king" in mobile work, due not only to



Power Supply Wiring Diagram

C_1, C_2—0.5-μfd. 200-volt tubular
C_3, C_4—.0008-μfd. 1000-volt mica
C_5, C_6—.002-μfd. 1600-volt tubular
C_7, C_8—20-μfd. 450-volt electrolytic
R_1—50 ohms, 1/2 watt
T_1, T_2—"Vibrator" type transformers, 6.3-v pri. 700-v. c.t. sec.
CH_1—15 hy., 250 ma. choke
L_1, L_2—15 turns of no. 14 s.c.c., 1/2" in dia., close-wound.
Vibrators — Regular "auto" type, non-synchronous
Relay—6-v. d.c. field, s.p.d.t.
FR_2, FR_3—5-prong wafer socket



CONSTRUCTIONAL DETAILS OF THE CONTROL HEAD

its rugged characteristics (in the hands of rather rugged individuals), but also to its inherent ability to exclude the background and extraneous noises so closely associated with mobile communication.

An optional but very convenient second mike receptacle may be installed on the power supply chassis in the rear, paralleling the one on the control head. This enables tuning and modulation checks to be made at the rear of

SHOWING ROUTING OF CABLES AND LOCATION OF THE TRANSMITTER UNITS

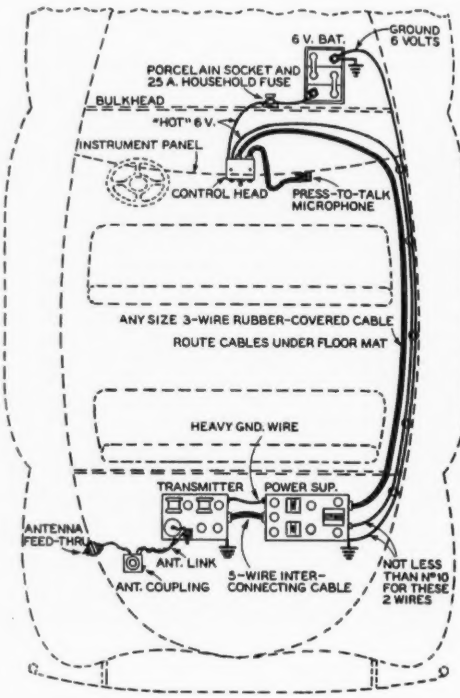
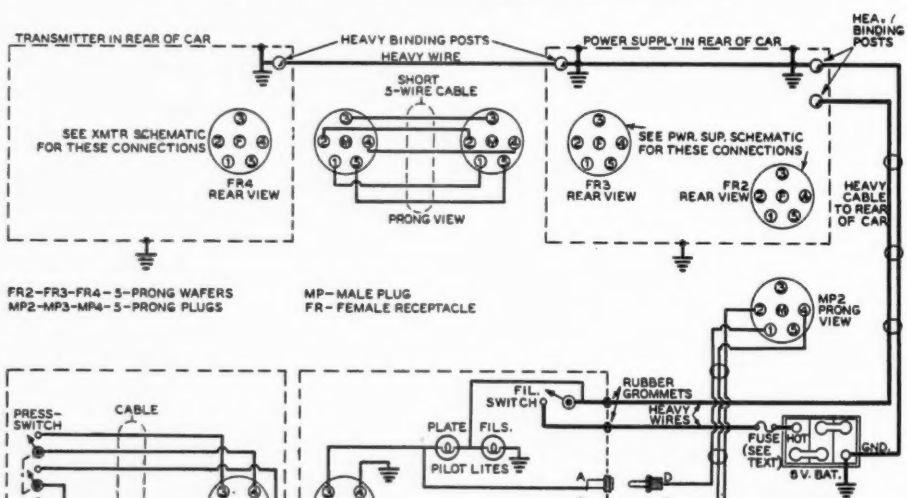
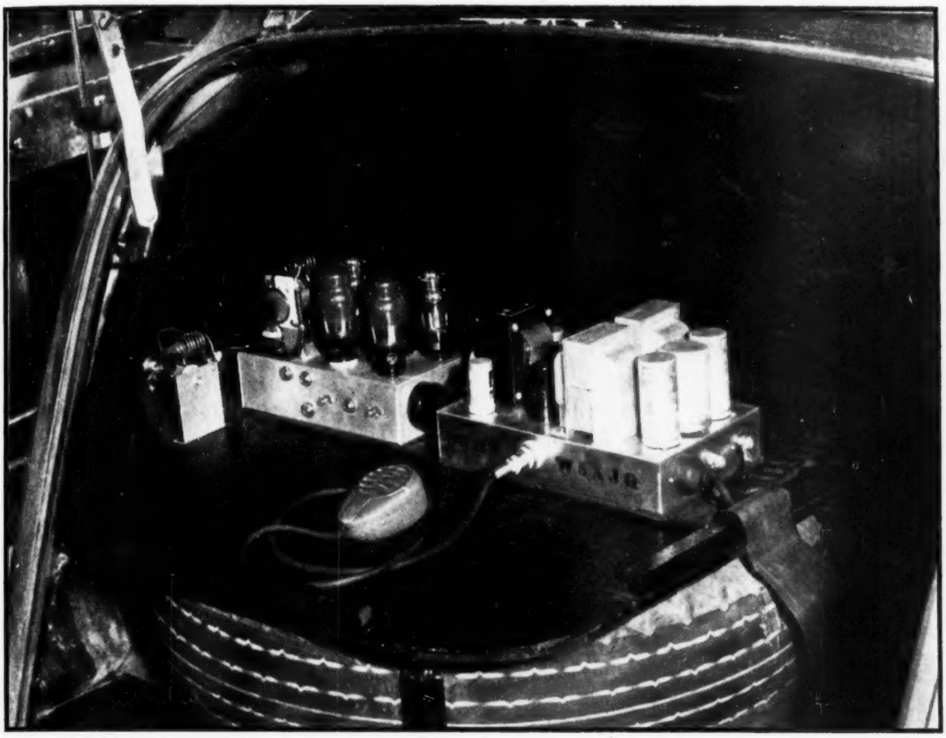


DIAGRAM OF THE INTERCONNECTING LEADS BETWEEN UNITS





The complete transmitter and power supply installed in the rear deck of the car. The antenna coupling unit may be seen mounted on its bracket at the left. Note the large copper ground strap running under both units. The microphone is shown plugged into the tune-up socket on the power supply chassis. Normally the microphone would be plugged into the control unit on the dash, of course.

the car, without the necessity of an extension cord or the help of another person.

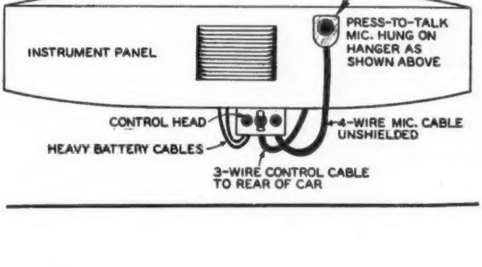
Interconnecting Cables

All control and battery feeder wires from the front of the car terminate at the power supply unit in the rear, from which point the proper wires are fed to the r.f. unit. The control wires (3) terminate on a 5-prong plug which plugs into the right hand side of the power supply unit. The hot side of the battery is first carried from the front-of-car battery location to the on-off switch in the control head, thence to the "A" hot terminal on the power supply unit in the rear of car. Another lead is run from the grounded side of the battery back to the power supply also. Do not trust the frame of the car to carry this return circuit. The majority of car bodies show poor electrical continuity.

These two feeder wires are, perhaps, the most important links in the complete set-up. Success or failure depends on whether sufficient voltage reaches the equipment. Therefore, make the two feeder wires as large as possible and under no circumstances less than No. 10.

[*Continued on Page 96*]

Method of mounting control head on dash and detail of microphone support



SUNSPOTS AND RADIO

By E. H. CONKLIN,* W9BNX

Any operator who is familiar with high frequency radio circuits knows that conditions change more or less regularly during each day and in the different seasons. Fewer, however, are acquainted with the trends which result from the sunspot cycle, which is approximately eleven years. This cycle is of particular importance now because five good years for the very high frequencies have just passed, to be followed by five poor ones, in which somewhat lower frequencies will have to be used to avoid skipping over the station to be contacted. The night frequencies of the past several years are becoming the day frequencies of the next few years. Therefore, a rhombic antenna might now be designed for the night frequency in use during recent years, so as to be more nearly optimum for future conditions.

A study of radio conditions can be remarkably simple in its approach, requiring only a general understanding rather than a knowledge of technical factors, or of mathematics beyond simple arithmetic. For those who are interested in the subject, therefore, the relations between sunspots, the ionosphere, and variations in the earth's magnetic field are shown in the accompanying figures.

Annual averages of an index of visible spots on the sun's surface (Zurich relative sunspot numbers) are plotted in the upper part of figure 2. The lower part of this figure is a similar plot of the measured critical frequency of the F_2 layer of the ionosphere.

Reflections in the F-region in the ionosphere usually bring about all reception of high frequency signals from beyond the range of the ground wave. The critical frequency is defined as the highest frequency that will be turned down by the ionosphere layer and, in this case, refers to signals going straight up and received at a point near the transmitter. Generally, the highest frequency that will be returned to the earth by the F-region of the ionosphere will be about three times the critical frequencies shown in the figures.

From figure 2 it will be seen that there is a close connection between sunspots and radio conditions if annual averages are used. Monthly data are given in figure 1. While the general shape of the top curve showing sunspot numbers is similar to that of the critical frequencies charted in the second curve, seasonal factors are obviously entering into the changes in radio conditions, and close association between variations in the two series of data are not evident. The third part of figure 1 indicates that the height of the layer varies only with the season. Magnetic activity at the bottom also does not follow closely the other data, but reached a maximum value in 1939, somewhat after the peaks of other series.

Conditions during the summer of 1941 are likely to be but little different from 1940 and typical for summer conditions over the next four or five years. The major difference will

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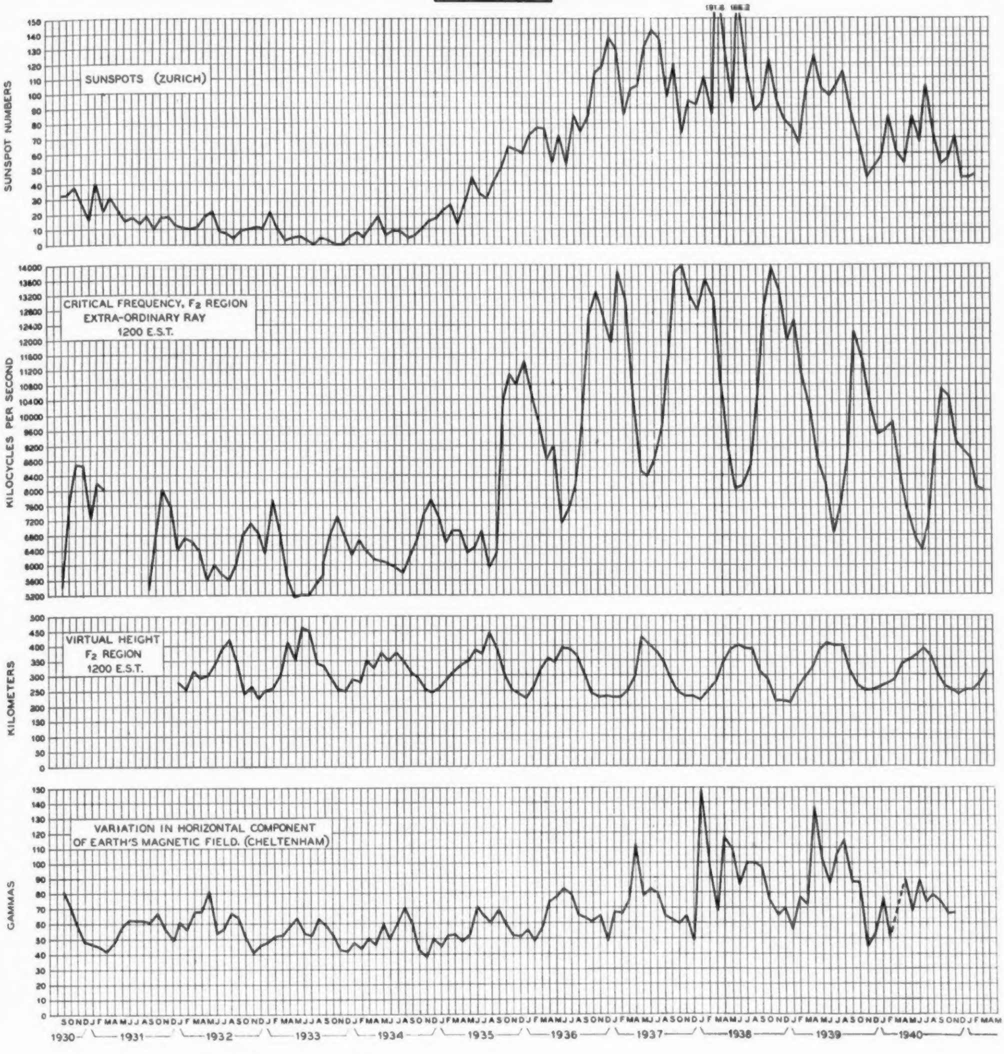


Figure 1

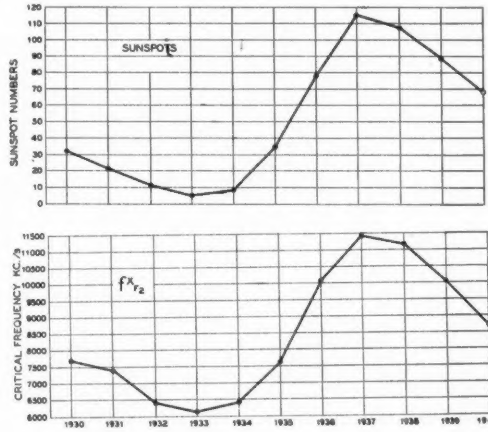
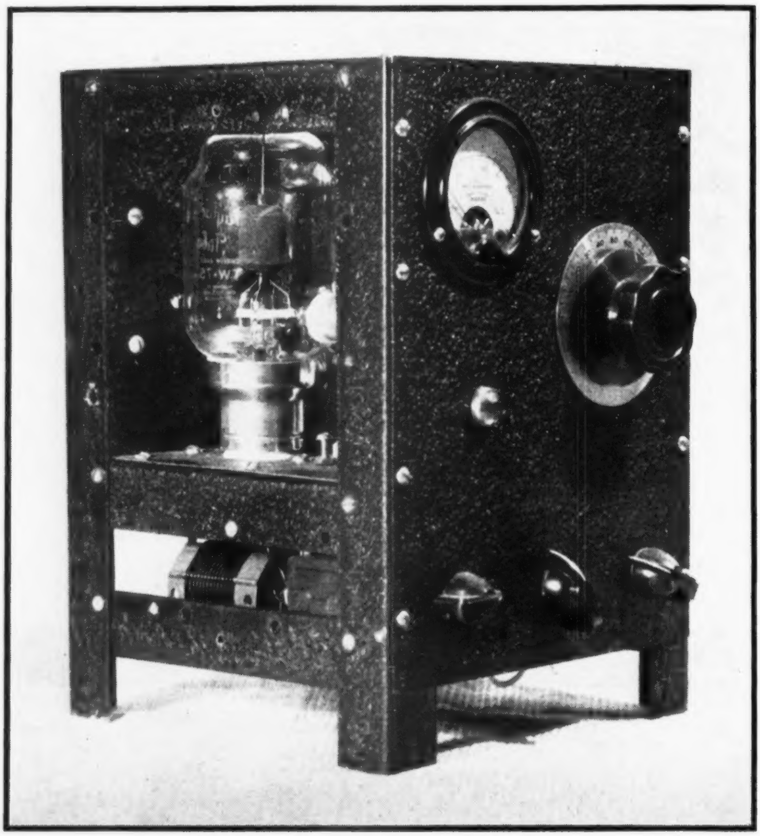


Figure 2

be in the winter conditions when the higher frequencies will not show their seasonal usefulness.

The above comment refers to F-region reflections. There are also periods, especially from May through August, in the northern hemisphere, when unusually high frequency signals will be received for a few hours, with a shortened skip distance, due to sporadic "clouds" in the E-layer.

Additional and more detailed information about the ionosphere and radio conditions is contained in Letter Circulars 614 and 615 published by the National Bureau of Standards and in the Radio Handbook.



The final stage using the TW-75 tube is mounted on a sub-base three inches up from the bottom of the rack. The oscillator and doubler stages are mounted below this base.

¼ Cubic Foot—¼ Kilowatt

By HOWARD BURGESS,* W9TGU

The idea really isn't anything new! It's just that the new types of transmitting tubes make possible high power in miniature transmitters. Transmitters almost as small as the midget broadcast sets on the market and smaller than the average communication sets are possible. In the "good old days" a quarter-kilowatt transmitter filled the good share of a room. After reading the characteristics of one of the late tubes it was decided to set a size limit and see what could be done.

The size was set on the basis of one kilowatt of power for one cubic foot of space. As the tube chosen would best handle 250

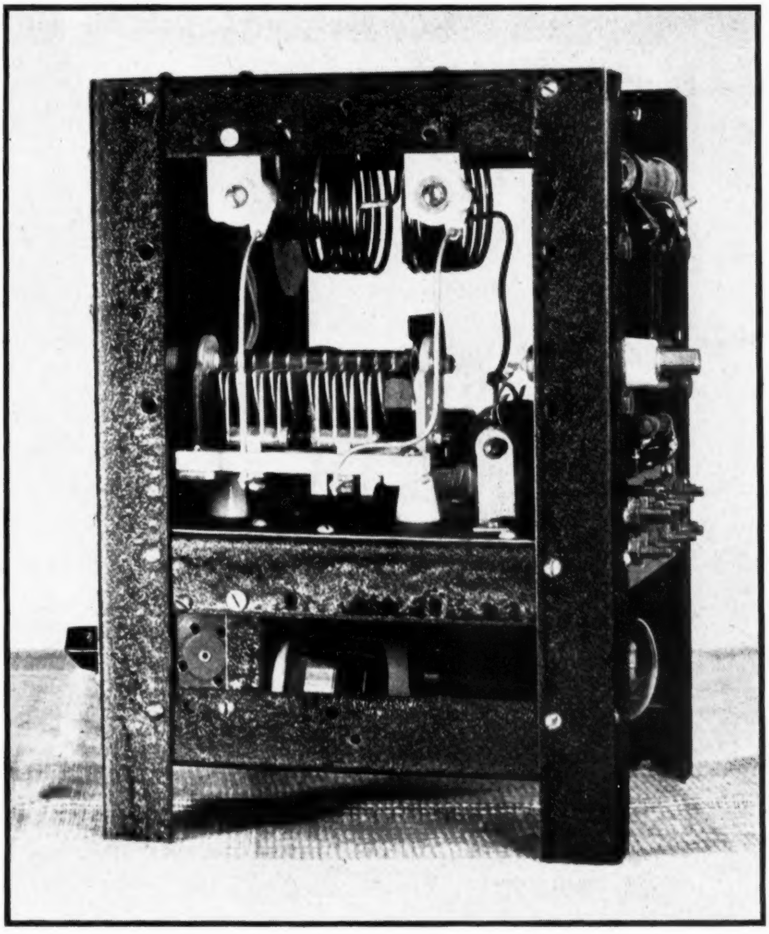
*Elliott, Iowa.

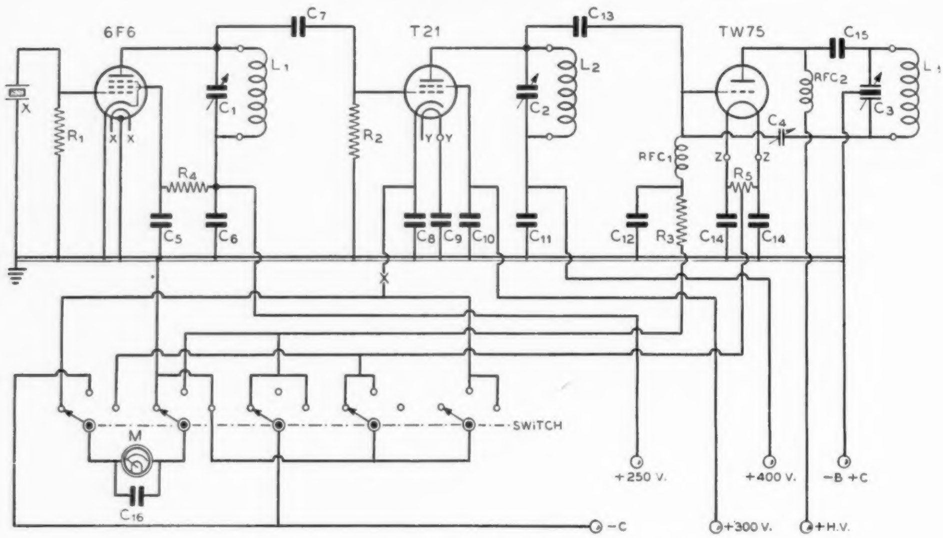
watts of power without overload, this set our size limit at one-fourth cubic foot. Digging out some grammar-school arithmetic we find that there are 1728 cubic inches in a cubic foot. One fourth of this leaves us about 432 cubic inches in which to put a complete three-stage r.f. section for a 250-watt transmitter. After much mental stacking and restacking of cubic inches, the 432 individual cubes of vacant space formed themselves into a body measuring 7" by 6-6/7" by 9" ready to be filled with radio gear.

A small box-type frame was made from 1-inch angle iron. This angle iron was bent from 20 gauge material. The finished frame is nine inches high, seven inches wide and six and six-sevenths inches deep. To aid in cooling the transmitter, the vertical irons were made one inch longer to form short legs and thus lift the entire transmitter an inch above the table top.

Next came the problem of locating the parts. We put the same old "horse" in front of the same old "cart" and grabbed the bull by the horns. In other words a conventional circuit and parts list were decided upon, hoping that somehow they would go into the required space. The circuit used consists of a 6F6 crystal oscillator, a T-21 doubler and a TW-75 in the final. A 6F6 was chosen because of its small physical size, the T-21 because of its ability to double efficiency, and the TW-75 for its power handling capabilities combined with compact structure. So much

Side view of the transmitter showing the tank circuit for the final amplifier and the manner in which the resistors by-pass condensers, and terminal strip are mounted on the rear of the miniature rack.





Wiring diagram of the quarter-kilowatt transmitter.

C_1, C_2—100-μμfd. midget variable
C_3—50-μμfd. per section, 4500-volt spacing
C_4—Disc-type neutralizer
C_5, C_6—0.05-μfd. 600-volt tubular
C_7—.0001-μfd. mica
C_8—0.1-μfd. 400-volt tubular
C_9, C_{10}—0.05-μfd. 600-volt tubular
C_{11}, C_{12}—0.001-μfd. mica
C_{13}—.0001-μfd. mica
C_{14}—0.001-μfd. mica
C_{15}—0.005-μfd. 2500-volt mica
C_{16} — 0.01-μfd. 400-volt tubular
R_1—50,000 ohms, 1 watt
R_2—100,000 ohms, 2 watts
R_3—10,000 ohms, 25-watt slider type
R_4—30,000 ohms, 2 watts
R_5 — 100-ohm center-tap resistor
RFC_1 — 2½-mh. 125-ma. choke
RFC_2 — 2½-mh. 500-ma. choke
Switch — Three-position five-gang
Coils—Suitable for bands in use

power in so small a space is sure to cause feedback and neutralizing trouble so the T-21 is operated as a doubler at all times. This stops any chance of feedback from final to oscillator.

To meet the metering problem in the least space a single meter with a three position switch is used to measure doubler plate current, final grid current, and final plate current. For safety's sake all current measurements are made in the cathode and filament returns.

It didn't take any crystal gazing to see that the usual method of mounting the tubes on a chassis or sub-base was out. The largest sub-base possible would be 7″ x 6″ and all of this is needed for the final. For the final solution a sub-base was mounted three inches up from the bottom. The final was mounted in the usual fashion on this. This meant that the crystal oscillator and doubler would have to be mounted horizontally under the sub-base. The photograph will tell more how this is done than words can.

Figure 3 shows how the 6F6, T-21 and the oscillator coil are mounted on the false panel suspended from the sub-base. Between this false panel and the panel are mounted the grid resistors for oscillator and doubler, the bypass and coupling condensers for these two stages, the oscillator tuning condenser, and the metering switch. All of these are mounted in this small space. For this reason it is best to take the wiring in this part slowly and check each part twice. A mistake is hard to remedy here once all of the parts are in.

Perhaps cramping the oscillator in this fashion may reduce its efficiency but its power output is about the least of our worries when driving a beam power tube. The plate tuning coil and condenser for the T-21 are mounted along side of this tube at the end of the false panel. The TW-75 is mounted directly above these, which gives a short connection to its grid.

The plate tuning circuit and neutralizing condenser for the TW-75 are mounted above the sub-base with the tube. Split stator tuning is used in the final. Although a condenser of sufficient voltage rating is used, shunt feed is used to remove the high d.c. voltage from it, thus reducing somewhat the peak voltage it must stand. It is almost impossible to get a larger condenser in the available space, so

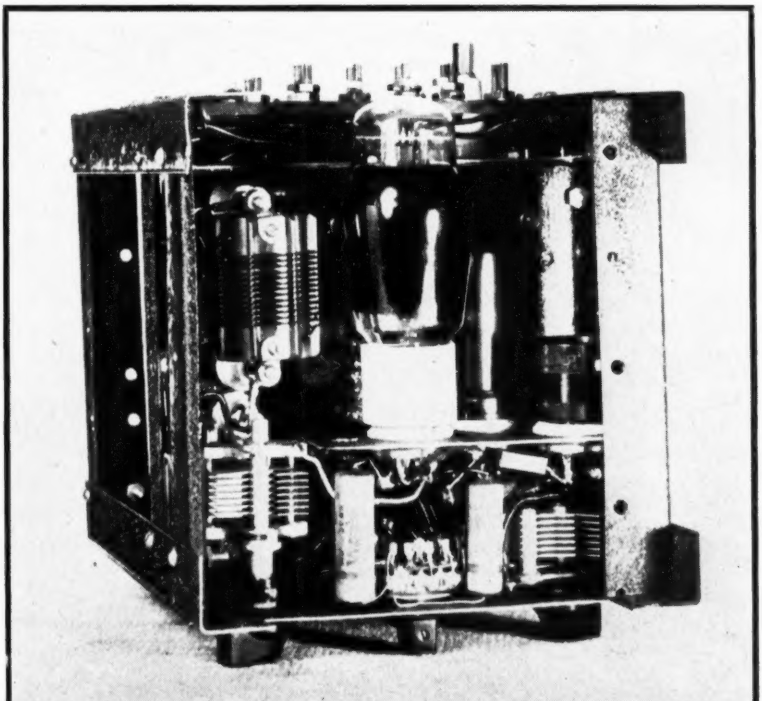
when very high voltage is used the transmitter should be tuned up with lower voltage and the load applied. The plate voltage can then be increased with less chance of breakdown.

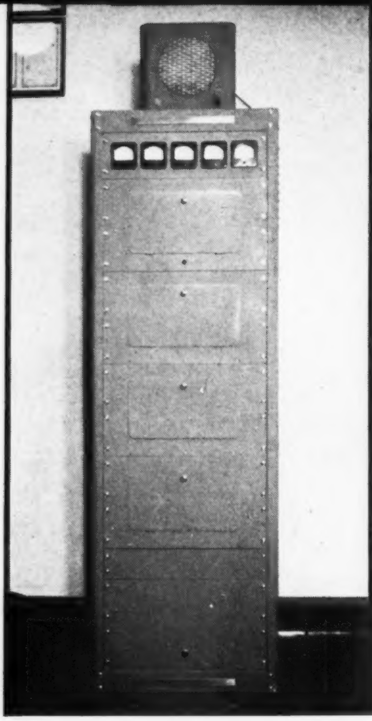
The back of the rack above the sub base is set in 7/8". This leaves a place on the back for mounting the final grid resistor and various bypass condensers. A combination of fixed and resistor bias is used on the doubler and final so keying can be accomplished in either the oscillator or doubler. All leads are brought out to a bakelite terminal strip at the rear, except the high voltage lead which is brought out to a high voltage standoff.

As the circuit is quite conventional anyone who has ever had any experience with transmitters will have no difficulty with it. Although this compact layout may not appeal to many of the gang, it should find a place with the fellow whose operating space is limited. With a little consideration the power supply should be but slightly larger than the transmitter. This combination should make a good medium power standby transmitter which could be tucked under the table, the tubes doing double duty in the regular rig.

In conclusion I would like to extend my sincere thanks to Rex Munger for his swell cooperation in the design of this piece of apparatus.

The exciter portion of the transmitter: one 6F6, one T-21, two tuned circuits, assorted coils, condensers, and switches. This photograph is of the bottom side of the transmitter.





A Low Powered POLICE TRANSMITTER

By VAL SHANNON,* W6DJS

Figure 1. The completed installation including r.f. section, modulator, power supply, and the three receivers. Notice the door panels on the various decks to allow for ease of tuning and maintenance.

After completing the installation of a low powered police transmitter, the author felt that several items concerning the installation might be of interest to the amateur. There are many things concerning the construction of such transmitters that apply equally well to amateur transmitters. The installation consisted basically of a transmitter that would meet either the 50-watt or 100-watt specifications of the F.C.C. The installation called for only a 50-watt transmitter (100-watt input), but the additional cost of making it capable of a 100-watt rating was small enough to warrant this feature. Space limitations demanded that the receivers, as well as the transmitter, be housed in a single cabinet, and with the exception of the special amplifier, the complete station is housed in a single cabinet.

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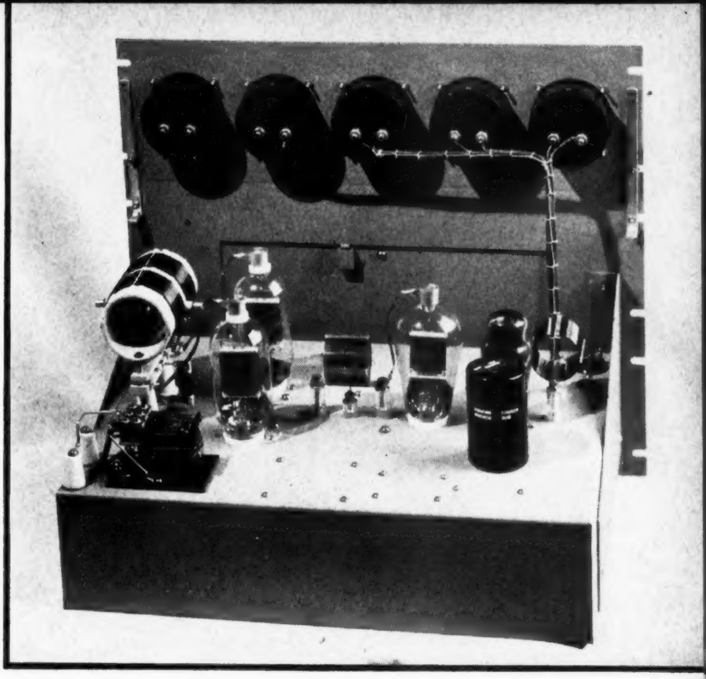
The Transmitter

In designing the transmitter, attention was paid to minimizing the number of parts and circuits in order to minimize the possibility of future failure. Therefore the circuit follows a very conventional pattern and possibly its construction offers the greatest appeal to the ama-

Figure 5. The power supply and modulator chassis. The cable connectors for speech input, 110 a.c. input, and plate power output can be seen on the rear drop of the chassis along with the three fuses for various portions of the circuit.

Figure 3. Rear view of the r.f. chassis and the meter panel. Note the plug-in temperature controlled crystal unit and the cut-down 160-meter coils which are used throughout the r.f. section.



teur. The r.f. section is built on a standard 17" x 13" x 4" chassis, and is recessed behind the front panel one inch so that the tuning controls will be enclosed behind the doors on the front panel. This is necessary in order that the tuning controls will not be tampered with by unauthorized persons. The panel door swings down, and there is plenty of clearance for all tuning procedures. The number of controls is minimized in order that ease of operation will be gained.

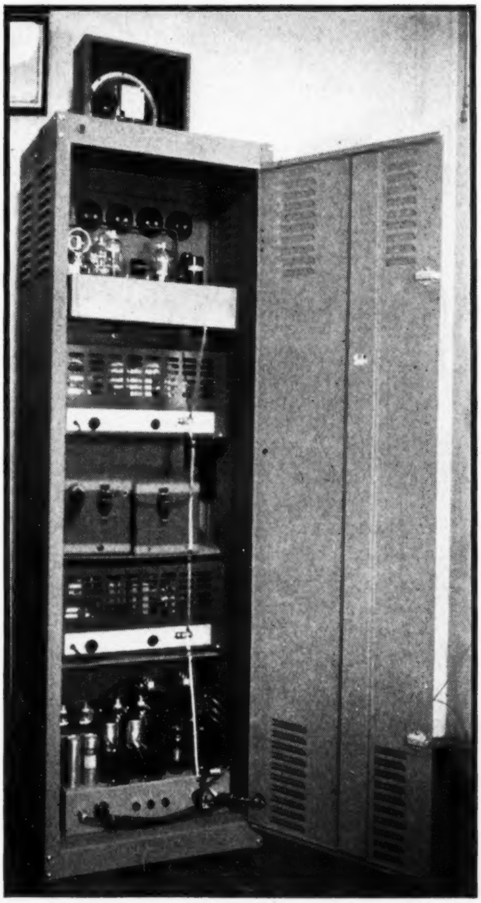
The R. F. Lineup

The oscillator stage is a 6F6G in the typical pentode circuit, and is designed to run as easily as possible so that the crystal drift will be as low as possible. The crystal oven is used to keep the crystal at a constant temperature. A small padding condenser is paralleled across the crystal in order to adjust its frequency deviation to practically zero. As crystal manufacturers generally cut their crystals higher in frequency than is desired, it is possible, by use of the padding condenser, to lower this frequency until it is right on the nose.

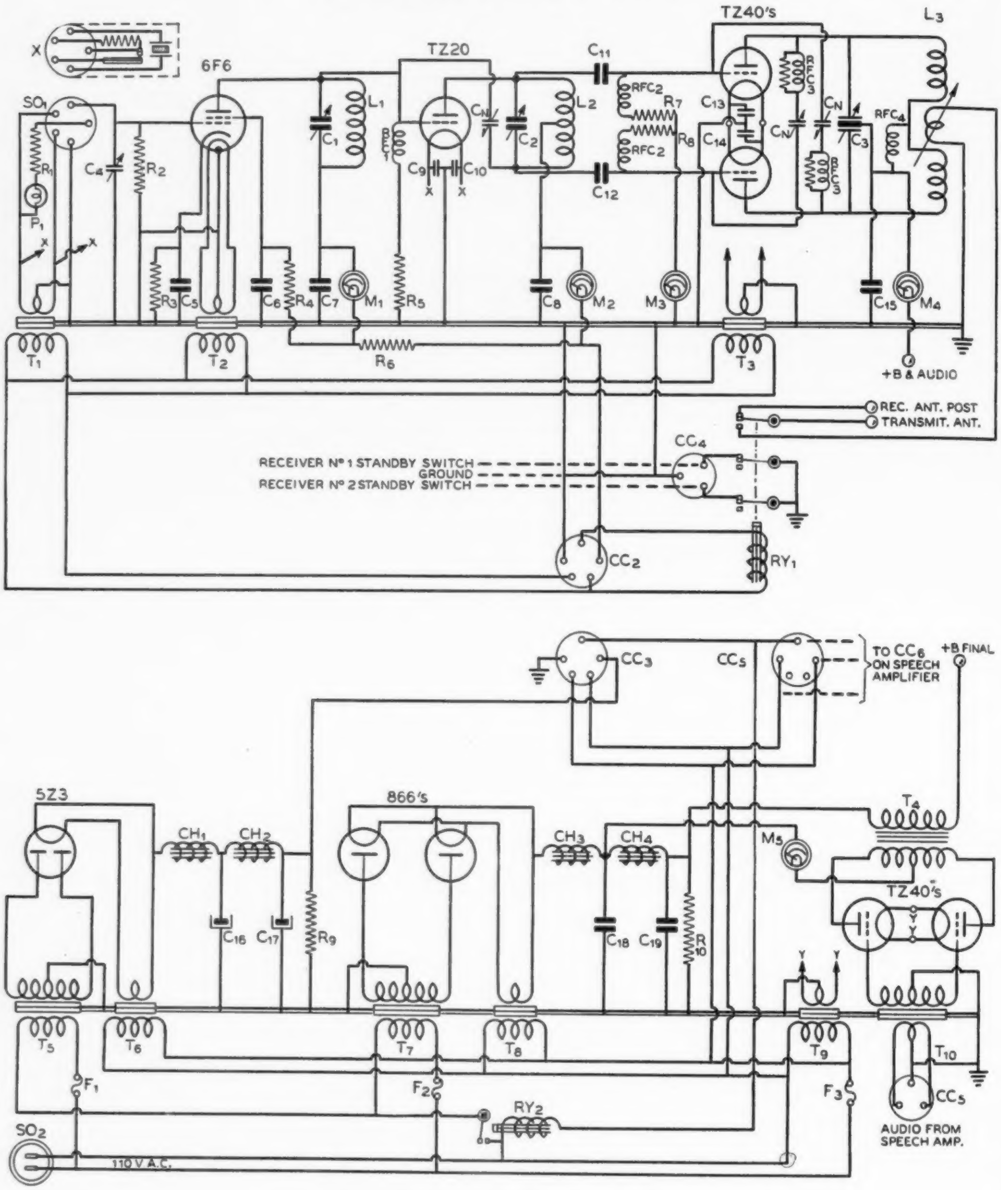
The oscillator is capacitively coupled to the buffer stage, which consists of a single TZ-20, running with about 500 volts on its plate. This stage also is conventional in that it has no parts that are not essential to the working of the transmitter. The by-pass condensers in both the oscillator and buffer stages are thousand volt tubulars which seem to be gaining in popularity for use in this work. The coils for these two stages are the popular plug-in coils designed for 160-meter operation, with a few of their turns trimmed off. They are ideal for this work in that they are compact and quite efficient.

Inspection of the photographs will show the mechanical lay-out and its compact nature.

Figure 2. Rear view of the installation showing the r.f. section at the top, the 1682-kc. receiver next below, the 30,580-kc. receiver, the 2414-kc. receiver, and on the bottom deck the power supply and modulator for the transmitter.



TRANSMITTER WIRING DIAGRAM



In Figure 1 is shown the capacity coupling between the buffer and the push-pull final. This is a very simple coupling system and worked out very fine in this case. More than ample grid drive is obtained and no necessity was found for tapping down on the coil to get a better match.

The final stage consists of push-pull TZ-40's, and is conventional in all details. Parasitic chokes were found necessary, possibly due to the fact that the neutralizing condensers were placed under the chassis rather than as close to the plate as possible. This was tolerated because it was designed to keep the top of the chassis as clear as possible in order to facilitate cleaning.

The r.f. section contains all filament transformers necessary for the r.f. tubes and the

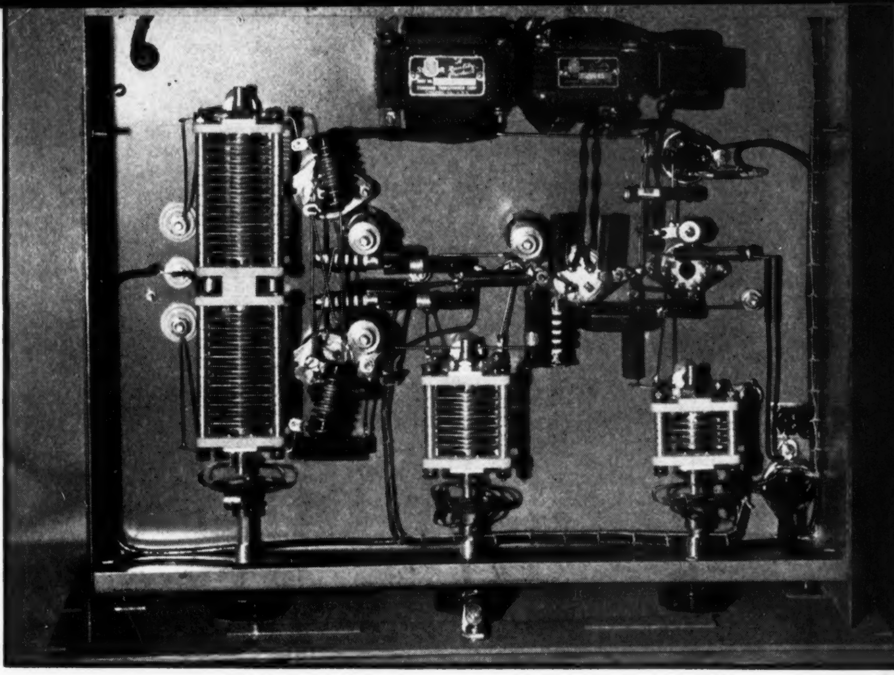


Figure 4. Underchassis view of the r.f. section showing the recessed tuning dials which are accessible when the door in the front panel is opened. Notice the underchassis mounting of the neutralizing condensers.

crystal heating element. A relay is also shown at the rear of the deck. This is used to transfer the antenna from transmit to receive positions and to mute the two low frequency receivers.

Power Supply and Modulator

Two power supplies are used: one 500-volt supply, and one larger supply capable of either 750 or 1000 volts output.

The modulator is excited from a 500-ohm line-to-grid driver transformer. The modulator tubes are TZ-40's and operate into a universal modulation transformer. It will be noticed that there is no bias supply included. This was eliminated by the use of zero-biased tubes throughout. The control circuit for the complete transmitter consists of one common 110-volt lead, a second 110-volt lead energizing the filament transformer, and the third 110-volt lead controlling the relay circuits that energize the power transformers and operate the antenna relay. This feature was found to be as effective as it is simple. The r.f. section, the power supply, and the modulator and speech amplifier all have these three 110-volt wires common between them. That is, the filament pair is common for all three sections, and once the power

[*Continued on Page 80*]

List of Parts Referred to in Wiring Diagram

C_1—50-$\mu\mu$fd. variable, 0.045" spacing
C_2—50-$\mu\mu$fd. variable, 0.075" spacing
C_3—100-$\mu\mu$fd. per section, 0.075" spacing
C_4—3-30-$\mu\mu$fd. mica trimmer
C_5, C_6, C_7—0.01-μfd. 600-volt tubular
C_8—0.01-μfd. mica
C_9, C_{10}—0.01-μfd. 600-volt tubular
C_{11}, C_{12}—.0001-μfd. mica
C_{13}, C_{14}—0.01-μfd. 600-volt tubular
C_{15}—.004-μfd. 2500-volt mica
C_{16}, C_{17}—2-μfd., 1000-volt, oil filled
C_{18}, C_{19}—2-μfd., 2000-volt, oil filled
CN—4.75-$\mu\mu$fd., max., neut. cond.
Omitted from the diagram is a .00005-μfd. mica coupling condenser in the lead from the 6L6 plate to the TZ-20 grid.
R_1—5 ohms, 10 watts
R_2—30,000 ohms, 2 watts
R_3—400 ohms, 10 watts
R_4—50,000 ohms, 10 watts
R_5—20,000 ohms, 10 watts
R_6—10,000 ohms, 25 watts
R_7 R_8—2500 ohms, 10 watts
R_9, R_{10}—50,000 ohms, 75 watts
RFC_1, RFC_2—2.5 mhy., 125 Ma.
RFC_3—Parasitic Suppressors
RFC_4—2.5 mhy., 250 ma.
T_1—7.5 v., 4 a.
T_2—6.3 v., c.t., 1 a.
T_3—7.5 v., c.t., 8 a.
T_4—Modulation transformer, 300 watts
T_5—1200 v., c.t., 250 ma.
T_6—5 v., c.t., 3 a.
T_7—2400 v., c.t., 250 ma.
T_8—2.5 v., c.t., 10 a.
T_9—7.5 v., c.t., 8 a.
T_{10}—Driver transformer, variable ratio
X—2414-kc. temperature-controlled crystal
P_1—6.3-v., 250-ma. pilot lamp
RY_1—Three-pole, double-throw relay, 110-v. coil
RY_2—S.p.s.t. relay, 110-v. coil
$CC_{1, 2, 3, 4, 5}$—Cable connectors, 5 terminal
CH_1—8-30 hy., swinging, 200 ma.
CH_2—15 hy., 200 ma.
CH_3—5-25 hy., swinging, 400 ma.
CH_4—12 hy., 200 ma.
F_1, F_2, F_3—3-a. fuses
M_1—0-50 ma.
M_2—0-100 ma.
M_3—0-100 ma.
M_4—0-300 ma.
M_5—0-250 ma.
L_1—Manufactured 160-meter coil, 10 turns removed
L_2—Manufactured 80-meter coil, used "as is"
L_3—Manufactured 160-meter coil, 16 turns removed

A CATHODE-RAY INDICATOR

For the Rotary Beam

By JOHN L. MAC ALLISTER *

One of the major problems encountered in remotely controlling the orientation of a rotatable beam antenna is that of determining from the operating position where the beam is being directed at any given time.

Often enough, the solution to this problem rests in a selector switch actuated by the rotation of the antenna support, a number of indicator lamps arranged about a map at the operating position, and an inter-connecting cable of from ten to twenty wires. The obvious disadvantages of such an indicator lie in the plurality of conductors required between antenna and indicator, and in the somewhat formidable proportions of the indicating equipment.

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The same job can be capably handled by a small cathode-ray tube, the indication being accomplished by causing the fluorescent spot to be positioned at a corresponding point near the perimeter of the tube screen for any given antenna bearing. Particularly advantageous is the fact that by using the c.r. tube as an indicator, the inter-connecting cable is reduced to five wires at most, while the number of indicated points through 360° rotation is limited only by the number of points on the selector switch. Moreover, the resulting indicator is pleasing to the eye, accurate, and sufficiently small in size that it can be desk mounted, or incorporated directly into the control panel. And it represents down-right economy when you consider that the device leads a double life.

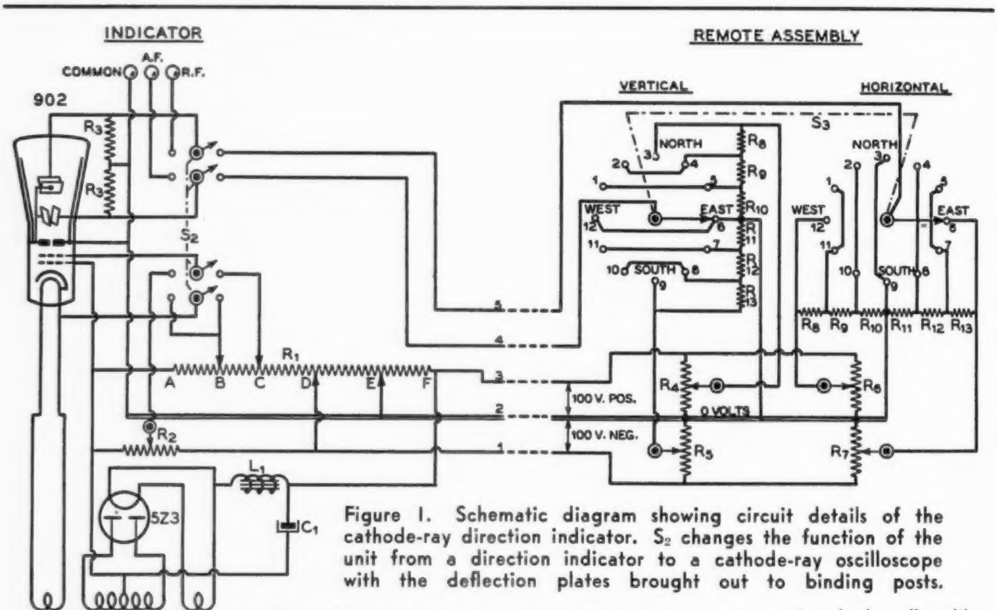


Figure 1. Schematic diagram showing circuit details of the cathode-ray direction indicator. S_2 changes the function of the unit from a direction indicator to a cathode-ray oscilloscope with the deflection plates brought out to binding posts.

C_1—8-μfd. 500-volt electrolytic
R_1—30,000 ohms, 50 watts, slider type
R_2—100,000-ohm potentiometer
R_3—10 megohms, ½ watt
R_4, R_5, R_6, R_7—500,000-ohm potentiometer
R_8—50,800 ohms, ½ watt
R_9—148,000 ohms, ½ watt
R_{10}—200,00 ohms, ½ watt
R_{11}—Same as R_{10}
R_{12}—Same as R_9
R_{13}—Same as R_8
S_1—S.p.s.t. on off toggle
S_2—4-pole double-throw switch, "anti-capacity" type having off position
S_3—2-gang, 2-circuit, 12-point, shorting-type rotary switch with detent mechanism
T_1—600 to 700 v. c.t., 30 ma. or less; 6.3 volt and 5.0 volt filament
L_1—15 to 30 hy., 30 ma. choke

By means of a simple switching arrangement, it serves as a conventional modulation monitor during transmission periods.

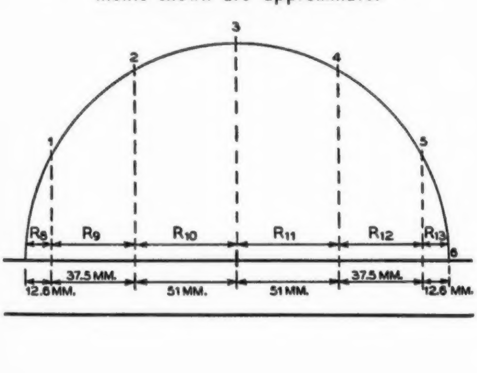
Operation

Basically, the indicator is the simplest sort of c.r. tube circuit. Plate, filament, intensity and focusing circuit details may be passed over momentarily as conforming with standard practice. Switch S3 (figure 1) in the remote assembly can be considered as the heart of the indicator since it constitutes the means for applying to the deflector plates of the c.r. tube the potentials necessary to deflect the electron beam to predetermined points about the perimeter of the tube screen as the beam is rotated.

Three general requirements for this switch are readily outlined. It must be capable of continuous rotation, necessitating, in some cases, the removal of a stop or, for that matter, the entire detent mechanism. It should be of the "shorting" type, to prevent jittering of the fluorescent spot as the switch contactors move from one contact to the next. And it should have an *even* number of symmetrically spaced contacts, sufficient in number to provide bearing indications at the desired number of points about the compass. The 12-point switch shown here permits an indicated bearing through 30° intervals, allowing a maximum error of but 15°. Actually, the indicator may be read to much less than 15° once you are familiar with its operation. Since the field of maximum radiation from a three element array covers an arc of some 25°, the switch shown can be considered adequate for all practical purposes.

Thus, the switch requirement is for a 2-gang, 2-circuit, 12-point, shorting-type switch. It is quite likely your dealer would not be able to supply it from stock, but 12 point decks of this type are standard manufacturer's items and are readily available.

Figure 2. Showing the general method of graphically calculating the resistor values for the remote network. R_{10}, R_{11}—51 mm = 200,000 ohms. R_9, R_{12}—37.5 mm = 37.5 × R_{11}/51 = 148,000 ohms. R_8, R_{13}—12.6 mm = 12.6 × R_{11}/51 = 50,800 ohms. Measurements shown are approximate.



The fixed resistances in the remote assembly are sufficiently close to being standard values to be available from stock. It is advisable, however, that they be checked off with an ohmmeter and the values shown closely approximated.

It should be noted that 500,000-ohm potentiometers R4, R5, R6, and R7 are provided as a means of independently increasing the included area on either portion of both vertical and horizontal axes of the c.r. tube. These may be considered as "expansion" controls, and are essential to facilitate initial adjustment of the indicator and to compensate for the usual manufacturing variations in cathode-ray tubes. The relatively high resistance values shown for these controls, and for the fixed resistors associated with S_3, are necessitated by the requirement that the cumulative resistance of the remote assembly should be several times that of the indicator voltage-divider R_1. In this way abrupt changes of resistance in the remote assembly, due to the shorting action of S_3, are prevented from affecting the focusing and intensity adjustments as determined by R_1.

The changeover switch, S2, is a conventional 4-pole double-throw, low-capacitance switch. With this switch in the "neutral" position the deflector plates and the focusing anode are unconnected, the cathode return of the c.r. tube is open, and the indicator is then made inoperative.

When the changeover switch is placed in the BEAM position, the cathode circuit is completed, the focusing anode is connected to slider "C" on R_1, and the vertical and horizontal deflector plates are connected to the rotors of their respective sections at R_3.

If S2 is then thrown over for OSCILLOSCOPE operation, the cathode circuit is completed as before, the focusing anode is connected to the variable tap on R_2, and the deflector plates are connected to terminals convenient for the application of r.f. and a.f. voltages.

Resistors R3 and R4 are the conventional 5 or 10 meg. resistors which serve to prevent an electrostatic charge from building up on the free deflectors during oscilloscope operation.

Circuit Details

The transformer used should have a 6.3-volt winding for the 902, a rectifier filament winding, and be capable of supplying from 300 to 400 volts at 15 ma. It is not recommended that a standard oscilloscope transformer be used

because of the high current requirement. Not much filter is required, a single section brute force filter being more than adequate for the job. Conforming with standard practice, the c.r. tube number 2 anode is kept at ground potential (tap "E" on R_1 to ground).

R_1 consists of a 30,000-ohm 50-watt resistor, four sliding taps being required as shown. The low resistance value is necessary, as previously explained, to provide stable focusing and deflection voltages under all conditions.

The beam intensity is controlled by moving the cathode tap "B", thus varying the grid bias offered at tap "A". Tap "B" can be considered as permanently adjusted once the proper setting is determined. The same applies to tap "C". With S_2 in the BEAM position, this tap serves as a focusing adjustment. For OSCILLOSCOPE operation the beam is focused in the conventional manner (R_2).

Bleeder taps "D", "E", and "F" should be permanently set in such relation that "D" and "F", respectively, are 100 volts negative, and 100 volts positive with respect to tap "E" (number 2 anode of the c.r. tube).

In this manner negative and positive potentials with respect to the number 2 anode are established and impressed across the expansion controls R_4, R_5, R_6, and R_7 in the remote assembly. The desired portion of this voltage is then transmitted to the resistor networks associated with the two sections of S_3. It is to be noted that the mid-points of these networks are maintained at anode potential, as are the mid-points of the expansion controls; they are directly connected by means of wire 2 of the interconnecting cable.

As shown in figure 1, the rotor of S_3-Ver. is connected to a contact of the changeover switch S_2, as is the rotor of S_3-Hor. (wires 4 and 5 respectively). Thus, with S_2 in the BEAM position, the voltages taken off at any position of S_3 are impressed directly upon the vertical and horizontal deflector plates of the c.r. tube.

To further analyze the action of S_3, consider S_3-Ver., specifically. It is apparent that with the rotor in position 3, (North), the maximum available positive potential with respect to the number 2 anode is impressed upon the vertical deflector, fixing the electron beam at the top of the vertical axis. (Approximately 70 volts is sufficient under normal circumstances.) This voltage is determined by the setting of R_4.

It is further apparent that one revolution of S_3, starting with the switch contactor at position 3 (North), will cause the fluorescent spot to progress in three steps from North down to the center of the tube screen (East/West axis, S_3 at position 6). With S_3 at position 9 the deflector will be at maximum negative potential with respect to the number 2 anode and the electron beam will be deflected to the bottom of the vertical axis. Continued rotation of S_3 then serves to move the fluorescent spot back to the East/West axis at position 12, and on to North again as the switch returns to position 3, completing one revolution.

The action of S_3-Hor., is identical to that of S_3-Ver. except that it controls the deflection of the electron beam along the horizontal axis of the tube. Their cumulative effect is to step the fluorescent spot about the perimeter of the tube screen as the switch is rotated, the requisite potentials being placed on the deflectors at each step to deflect the electron beam to a corresponding position on the tube screen.

Calculation of Resistors

The calculation of values for the resistors comprising the R_3 networks is not particularly complicated, but presents an interesting problem. Obviously, a greater increase of potential is required on the vertical deflector, for example, to deflect the electron beam one position above or below center, than to deflect it the comparatively short distance between points adjacent to the North or South ends of the axis. Therefore, the voltage, and consequently the resistance between taps varies in non-linear steps either side of the mid-point in these networks.

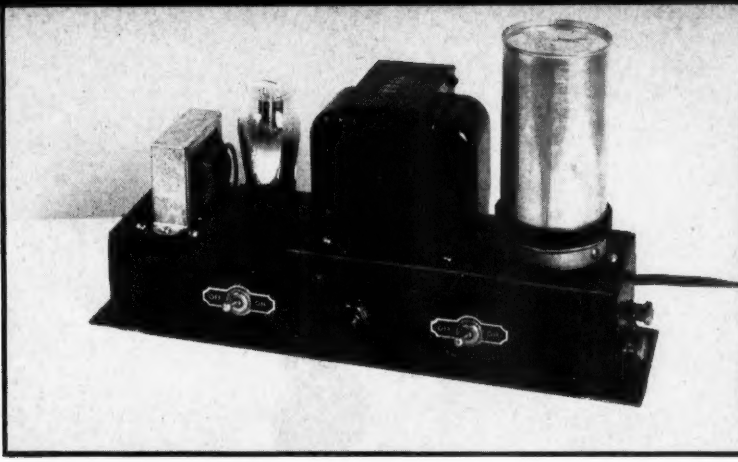
Since both networks are identical, only one need be calculated. Exact values are established in the following manner. S_3-Hor. covers six steps in rotating from East to West, (180°). These points should be laid out on a semicircle as shown in figure 2. They are then projected to intersect at right angles a base line representing the East/West axis. The distance between respective points as measured on the base line is then in exact proportion to the required resistance values.

Bearing in mind that we wish to keep the overall resistance of these net-works reasonably high, an arbitrary value of 200,000 ohms can be set for R_{10} and R_{11}. Calculation of the other resistors then resolves itself into a simple equation as shown in figure 2. Approximate values only are required, since discrepancies of two or three per cent would have little deleterious effect.

Construction

The panel arrangement and layout of the indicator will, in any case, be determined by individual requirements. The one described here was incorporated into the desk unit housing the exciter, speech-amplifier, and the antenna and transmitter controls. The four points of

[*Continued on Page 68*]



The a.c. and vibrator power supply. Many present a.c. supplies can be adapted to d.c. operation for emergency or portable work by following the information given in the article.

A Home Built

A. C. AND VIBRATOR POWER SUPPLY

By G. W. GUNKLE*

With the advent of spring, the writer decided to try some 2½-meter mobile work. However, after perusing several catalogs and making a few visits to the local second hand shops in quest of genemotors, vibrator supplies and similar devices, it was felt that construction of a power pack was in order if the cost of a mobile outfit was to be kept within a reasonable figure. The vibrator power supply shown in the photograph and drawing is the result.

The power supply operates with either 110 volts a.c. or 6 volts d.c. input and provides an output of 250 volts at 60 milliamperes. While this is not a great deal of output as judged by ordinary standards, a transceiver, so powered, is capable of providing quite a sizeable signal on the 2½-meter band. It is not intended that this power supply should be copied exactly, as there are a wide range of components that may be used to serve as a vibrator power supply. But it should serve as incentive to adapt other present a.c. supplies for d.c. operation. Such a supply should be handy to have around "just in case" for emergency work.

The power transformer used is a small one originally intended for receiver replacement or public address use. It has a 600-volt center tapped high voltage winding and a 6.3-volt and a 5-volt filament winding. The pulsating d.c. from the vibrator is applied alternately to the 6.3 and 5-volt windings. In spite of the 1.3-volt discrepancy between the two primary winding voltage ratings, the secondary voltage is quite easily smoothed out by the ensuing filter. Another transformer which has proved satisfactory is one which has two 2½-volt windings and one 5-volt winding in addition to the usual high-voltage secondary. The two 2½-volt windings were connected in series and together used as a 5-volt winding, thus giving the necessary two 5-volt primaries. While this transformer was not used in the final version, because a 6.3-volt filament winding was desired, its operation was quite satisfactory.

In any case, it is recommended that the transformer which is used be of good substantial construction with heavy filament windings and have plenty of core material. If one wishes to go to the expense, there are several transformers on the market designed specifically for a.c. and vibrator service and one of these may be used.

[*Continued on Page 73*]

*Pt. Vicente Radio Stn., San Pedro, Calif.

INTERCOMMUNICATION CIRCUITS

For Police Radio Systems

By RONALD L. IVES*

Within recent years, police radio systems have tended to become somewhat standardized, with the headquarters transmitter operating on a medium-high frequency, such as 2442 kc., and the car transmitters operating on "ultra-high" frequencies near 30 Mc. This has proven quite satisfactory for ordinary police work, in which the mobile units do not need to communicate with each other. The occasional inter-car intercommunications necessary in ordinary police work are vocally relayed by the headquarters operator.

In certain types of emergency police work, such as the "hot pursuit" of bandits, where close coordination of a number of mobile units is essential, the vocal relaying of messages from car to car via the main transmitter introduces a delay at a time when delays must be minimized, and increases possibilities of errors. In addition, the work load on the headquarters operator during a "hot pursuit" becomes too great, as he must not only relay all messages, but keep an accurate log of them, and, in many instances, also take care of a telephone.

To eliminate this headquarters bottleneck, a number of intercommunication, or "feedback" systems have been worked out by various police operators. A few are quite satisfactory. Most, although soundly designed from an engineering viewpoint, are almost useless in actual police communication work because of their complexity of operation.

Fundamental Requirements

To be of any real utility in police work, a feedback system must be simple, so that it can be constructed of standard parts by the local maintenance man, and so that any member of the force can operate it. It must not interfere with the standard operation of the transmitter and receiver, for the headquarters operator must hear and log all communications, and must be able to call any car at any time. The cost of construction and installation must be low, for police budgets are usually inadequate.

The following material describes a simple "feedback" system suitable for use with almost any type of police radio system. It has nearly all the advantages possible with such a system, including simplicity of operation, low cost, ease of installation, and adaptability to many types of equipment. In addition, it is practically blunder-proof, so that if a tired operator forgets to turn it off after the need for its use is past, no harm is done.

*New Dallas Hotel, Dallas, Texas.

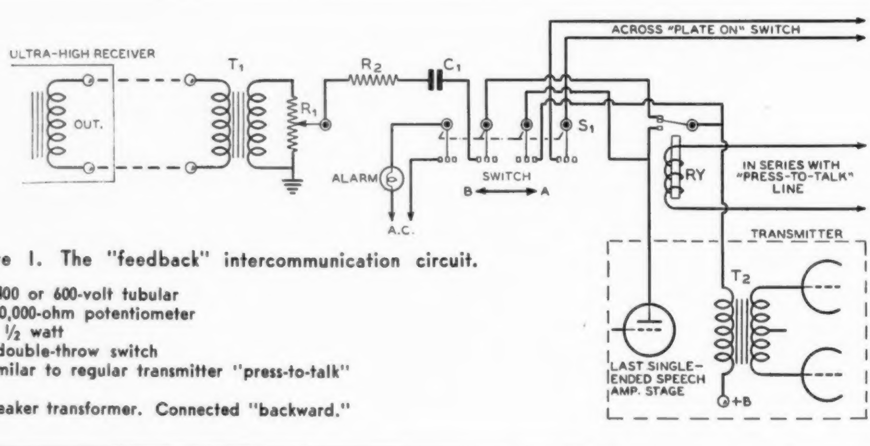


Figure 1. The "feedback" intercommunication circuit.

C_1—.002-µfd., 400 or 600-volt tubular
R_1—10,000 to 50,000-ohm potentiometer
R_2—2000 ohms, 1/2 watt
S_1—Four-pole double-throw switch
RY—S.p.s.t., similar to regular transmitter "press-to-talk" relay.
T_1—Plate to speaker transformer. Connected "backward."

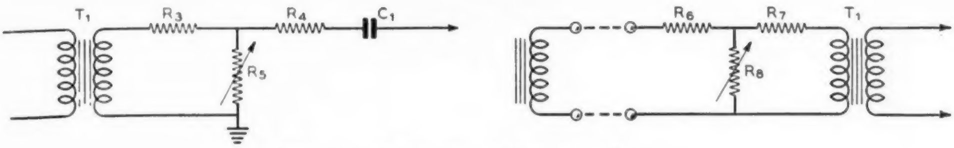


Figure 2. Alternative Attenuator Circuits.

R_3, R_4—Fixed resistors, value determined by experiment—see text.
R_5—5000-ohm potentiometer
R_6, R_7 R_8—30-ohm rheostats

Available Power

A check of the power output of the average police receiver operating on the ultra highs shows that the power supplied to the speaker exceeds by a considerable margin the output of the second a.f. stage of the average "station" transmitter modulator. There is thus a.f. power to spare when the receiver output is coupled into the transmitter audio channel. This permits use of rather inefficient equipment in the feedback system and greatly reduces the construction cost, without introducing loss of audibility.

Circuit Arrangements

By use of suitable transformers and switching equipment, the output of the "ultra high" receiver is fed into the station transmitter, via the last "single-ended" stage in the speech amplifier. The general circuit is shown in figure 1.

The a.f. power is secured from any convenient low impedance winding of the receiver output transformer. Most receivers are equipped with two or more low impedance output coils. One feeds the station speaker, while the others, in most instances, are unused. Audio from one of these windings is fed to the transmitter, where transformer T_1 is installed. If the line is less than about 10 feet long, it can be a simple twisted pair. If it is very long, center-tapping, by means of resistors at each end, with the center taps grounded, will stop unwanted pickups. The transformer T_1 is a "plate to dynamic speaker" transformer, of almost any make and impedance constants. The line connects to the "speaker" terminals.

Shunted across the high impedance winding of this transformer is a potentiometer, R_1, of relatively high resistance. Any value between 10,000 and 50,000 ohms will be satisfactory for R_1. The slider arm of the potentiometer is connected to a fixed resistor, R_2, of about 2,000 ohms. The two resistors act as an attenuator, to dissipate excess a.f. power.

The other end of R_2 is connected to one side of a .002-μfd. mica condenser having a rated voltage of about twice the plate voltage of the stage to which it is connected. The free end of this condenser, through the switching circuits, connects to the plate end of the output transformer of the last single-ended modulator stage.

When the feedback system is in operation, a.f. power from the ultra-high receiver is fed, via the line, coupling transformer, attenuator, condenser, switching circuits and primary of the plate transformer, to the push-pull modulator or driver stage, which, after proper adjustments are made, receives the same audio power on "feedback" as it does from the mike circuits.

Switching Circuits

The switching mechanism to put the feedback system into or out of operation must be of a "one motion" type because of personnel limitations, and must not only change the audio input system, but must turn on the modulator plate current when feedback is in use. At the same time it must keep the station microphone available for instant "break-in" use.

To make these multiple circuit changes, a three-pole double-throw toggle switch and a single-pole double-throw relay were found necessary. A switch well suited for the job is one of the old "anti capacity" switches popular about fifteen years ago. These switches are available at low prices, and mount conveniently in a small panel space. The relay is a duplicate of the "press to talk" relay already in the transmitter, and is connected in series with it.

Referring to figure 1, when the switch is at position A the receiver is disconnected from the transmitter audio channel and the plate end of T_2 is connected to the plate of the transmitter speech tube. The receiver and transmitter are independent, and operation of both is normal.

[*Continued on Page 70*]

Two Frequency STUB MATCHING

For many years the stubs used in matching transmission lines to antennas have been considered popularly from one viewpoint—for so long in fact, that it is difficult to believe that there is any other way to look upon them. The classic idea is that the stub is part of the antenna and has standing waves upon it, while the transmission line taps on to the stub at a matching point at which time it will have no standing waves. With only one exception that has come to our attention[1] this has led to a conclusion that antennas so fed and matched are single frequency systems, and that other means must be used if operation on two harmonically related bands is desired.[2]

Stub Matching

The usual stub-fed antenna is shown in figure 1. It will be seen that the standing waves on the feed line can be eliminated by placing the shorting bar at such a point that the antenna and stub are resonant with no error in tuning reflected into the line in the form of reactance; and by tapping the line on the stub at a point where the line is terminated in its characteristic impedance.

The above requirements have led to the suggestion that the first step in tuning with this arrangement is to resonate the antenna and stub using an r.f. meter in the shorting bar with the feed line disconnected and excitation received from a nearby antenna in order to obtain a preliminary adjustment.[3] It is often found, however, that standing waves of reduced amplitude will remain on the feed line, even at the best adjustment, until the shorting bar on the stub is readjusted moderately. This can be attributed to the fact that while a non-inductive resistor placed across the whole of a resonant circuit will not detune it, tapping the resistor across only part of a circuit will necessitate retuning. Other than cut and try methods, therefore, the suggestion might be made that the shorting bar can be adjusted more accurately if during this preliminary adjustment when the antenna is excited externally, a resistor equal to the characteristic impedance of the line is jumped across the stub at the approximate point where the feeders are to be attached, as indicated in figure 2. This, however, is not the new view of things that was promised in the beginning.

The Alternative Method

Let us throw away the picture given by figures 1 and 2, turning to figure 3 in which a double "zepp" antenna is shown with substantial standing waves appearing throughout the length of the feeder. Having assumed that the antenna is resonant, its inductive reactance is equal and opposite to its capacitive reactance, so the standing waves are caused by the fact that the antenna may "look like" a 72-ohm resistance that does not properly terminate the higher line impedance. For simplicity, let us assume a 600-ohm line. The antenna being resonant, there will be a current maximum at the middle of the antenna—which is at the end of the line—and, therefore, a current minimum a quarter wavelength down the line. The current at the maximum will have some value, depending upon the impedance at that point (about 72 ohms), and because the next quarter wavelength of line acts as an impedance transformer, there will be another value at the current minimum where the impedance in the example will be 5000 ohms, calculated as follows:

$$Z_0 = \sqrt{Z_1 Z_2}$$

Where Z_0 = line char. impedance
Z_1 = current at one point
Z_2 = current $\frac{1}{4}$ wave away

$$600 = \sqrt{72X}$$
$$360{,}000 = 72X$$
$$X = 5000$$

If the current at the maximum is 1 ampere, therefore, it will be only 0.0144 ampere at the minimum (from the equation $I_1Z_1 = I_2Z_2$). The current will vary between these points as will the impedance. At some point the resistive component of the impedance will cross the calculated transmission line impedance at which point standing waves can be eliminated by attaching a shorted or open stub to balance out the reactance. It can be shown that, with any load whatever, this point is between $\frac{1}{8}$ and $\frac{1}{4}$ wavelength from a current minimum towards the transmitter at which

point a proper value of inductive reactance will match the line. Also another point exists located between $\frac{1}{4}$ and $\frac{3}{8}$ wavelength from a current minimum towards the transmitter where the line may be matched by a shunt capacity only. This idea is shown in figure 4. If the stub is placed at any of the required points, which recur each half wavelength, and is the proper length, the line can be matched.

Two Band Operation

Let us forget that figure 4 is only figure 1 with the stub straightened out, and think in terms of the above reasoning. Let us now assume the use of a second frequency, not necessarily a harmonic. The stub shown in figure 4 can be considered as an efficient reactance doing nothing useful at the second frequency. There will again be standing waves and current maxima and minima along the line. A new point can be located where a stub can be attached in order to eliminate the new standing waves.

The first question that will be raised is, "What effect will this second stub have at the first frequency?" It will cause standing waves unless it is an infinite impedance at the first frequency. This can be done by extending the second stub upward beyond where it taps onto the line, until it is a quarter wavelength long at the first frequency. This results in a change in its value of impedance which must be compensated for by changing the length of the shorted section keeping the total length equal to $\frac{1}{4}$ wavelength. This is pictured in figure 5.

It will be seen from figure 5 that the method does not require a harmonic relationship between the two frequencies, nor does it require the use of a tuned or resonant antenna.

Practical Adjustment

While the above discussion mentioned the calculation of impedances—simple arithmetic, to be sure—the actual tuning does not require any knowledge of the impedances encountered. The only data necessary are the positions and ratio of a current maximum and adjacent minimum, and the characteristic impedance for which the line was designed. This knowledge simplifies the straight cut-and-try method.

The current must be measured only relatively, which can be done using a sliding meter jumped across a few inches of one of the wires, or preferably coupled with a loop to both wires of the line so that a single minimum will be obtained in the presence of harmonics or unbalance. One arrangement is sketched in figure 6. A piece of fibre tubing can be slotted lengthwise making two half cylinders to slide on the wires to provide a frame holding the meter and its coupling turn, and to support them at a fixed distance from the wires. The

[1]Willoughby, "Matching stub switching." RADIO, Feb., 1938, p. 23.
[2]Smith, "Antennas for 112 M." RADIO, April, 1940, p. 34.
Smith, "The expanded lazy-H array." RADIO, July, 1939, p. 23.
Jenkins, "Continuously rotatable two band array." RADIO, Jan., 1940, p. 87.
[3]RADIO HANDBOOK, 1941, page 412.

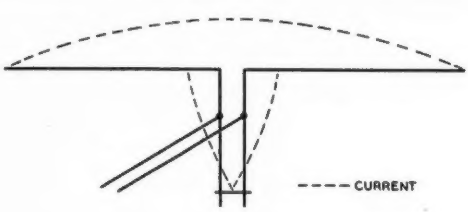


FIGURE 1

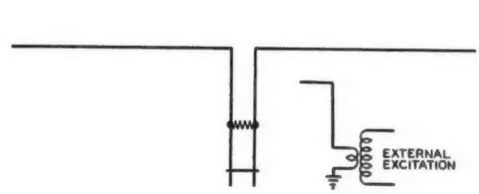


FIGURE 2

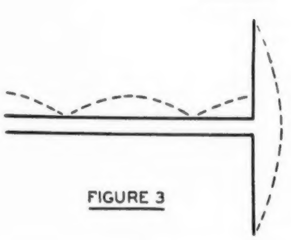


FIGURE 3

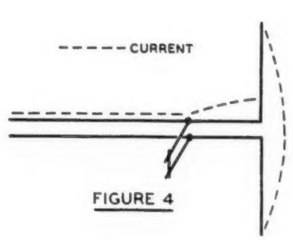


FIGURE 4

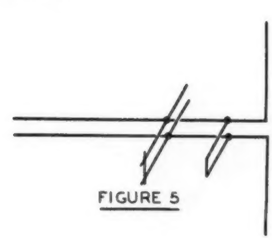


FIGURE 5

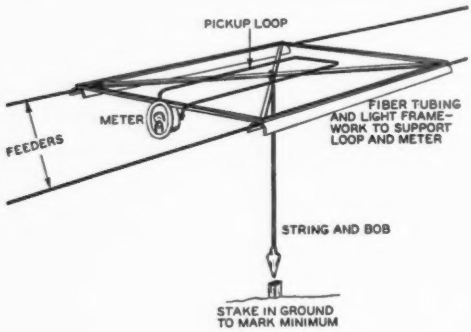


FIGURE 6

size of the loop depends on the meter sensitivity and the power used. A plumb bob fastened with string to the frame can be used to mark on the ground the position of the minimum.

The maximum and minimum current should be read and their ratio calculated. When this ratio is greater than ten, it will be necessary to estimate the value at the minimum. The position of the minimum should be marked on the ground; if the current is high, it will be necessary to locate two points of equal current and consider the point midway between them as the current minimum.

If the reflection ratio is less than about two to one, an open stub or a condenser (capacitive reactance) will probably be best for matching. More usually the ratio will be high and a closed loop, stub, or inductance coil (inductive reactance) will be required. Ordinarily, the first current minimum from the antenna will be used as a starting point, although any other can be used if it is more conveniently located. The stub should be placed at the distance from the current minimum toward the transmitter indicated by tables 1, 2, or 3, depending on the type of reactance used. The length of loop is also given in the tables. In order to permit an initial adjustment, the loop or coil size may be about ¼ larger than indicated in the tables, but not in excess of a quarter wavelength.

The stub or coil may now be placed on the line and the transmitter tuned. Next, the current ratio along the line, on the transmitter side, should be measured and recorded. The point of connecting the stub or coil may

[*Continued on Page 83*]

Table 1

Open loop or stub length and location (in wavelengths) toward transmitter from minimum current point to match transmission line.

CURRENT Max./min. ratio	STUB Length	DISTANCE from min.
1.5	0.064	0.358
2	0.098	0.348
3	0.135	0.333
4	0.155	0.324
6	0.176	0.312
8	0.188	0.305
10	0.195	0.300
15	0.205	0.292
20	0.211	0.286
30	0.217	0.279
40	0.222	0.275
50	0.224	0.272
70	0.229	0.268

Table 2

Closed loop or stub length and location (in wavelengths) toward transmitter from minimum current point to match transmission line.

CURRENT Max./min. ratio	STUB Length	DISTANCE from min.
1.5	0.188	0.140
2	0.151	0.152
3	0.115	0.166
4	0.095	0.176
6	0.073	0.189
8	0.061	0.196
10	0.054	0.201
15	0.042	0.209
20	0.034	0.214
30	0.028	0.220
40	0.024	0.224
50	0.021	0.227
70	0.017	0.231

Table 3

Coil impedance in ohms and location in wavelengths toward transmitter from minimum current point to match 600 ohm transmission line.

CURRENT Max./min. ratio	COIL Impedance	DISTANCE from min.
1.5	1400	0.140
2	860	0.152
3	535	0.166
4	405	0.176
6	300	0.189
8	255	0.196
10	220	0.201
15	180	0.209
20	155	0.214
30	120	0.220
40	100	0.224
50	90	0.227
70	75	0.231

Converting the TEN-METER ROTARY *to Twenty*

By K. G. VALENTINE,* W6CKD

Two years ago the writer spent a good deal of time, money and labor, in building a four-element ten-meter beam antenna, plus a twenty-foot tower mounted on top of a twelve-foot building. One-tenth wave spacing was used between the various elements. The beam really went to town until early this year, when, as predicted, "ten" began to slip out of the picture.

When I considered all that had gone into that beam, along with slim hope of getting much use out of it in the future, I just about broke into tears! Conversion into a twenty-meter beam had been considered, but after inspecting several such arrays, it was decided to forget the whole thing. The mechanical and engineering problems connected with the erection of a twenty-meter beam using elements some thirty feet in length, horizontally mounted, together with the cash outlay and labor involved, were just too much to contemplate!

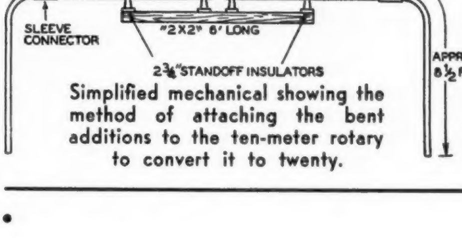
So I resorted to a 135-foot end-fed for twenty 'phone. But after two days of having the distant stations come back with, "Sorry, old man, didn't hear you come back," in about 75% of all contacts, I became convinced that to have any fun on this band a beam of some sort is a necessity.

In as much as it had previously been decided that a beam for twenty with horizontal elements was "out," some sort of compromise was in order. Furthermore, if the proposed change was to be made with a minimum of labor and expense, another compromise on spacing of elements must be made. The four-element beam had required a supporting structure 10½ feet in length. To increase that length to 13 feet, (for 0.1 wave spacing on twenty meters) I would have again encountered the two originally objectionable items of labor and expense.

Looking up at the "converted-from-ten" twenty-meter rotatable beam.

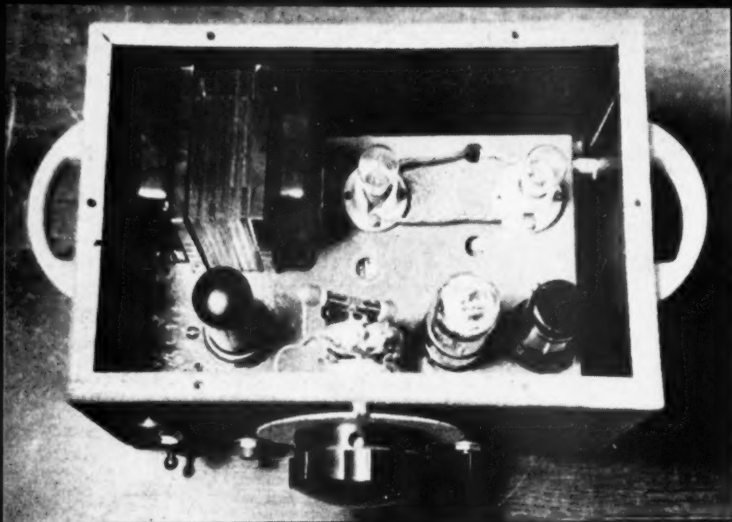
With some misgivings all of the ten meter elements were removed, leaving the rest of the structure "as is." Next on the program was a trip to the local electrical dealer, where six 10-foot sections of ½-inch thin-wall conduit were purchased, together with six sleeve-type couplers. The dealer was persuaded to bend one end of the each pipe, as near the end of the

[*Continued on Page* 72]



Simplified mechanical showing the method of attaching the bent additions to the ten-meter rotary to convert it to twenty.

*141 Pacific Avenue, Santa Cruz, California.



Top view of the oscillator with the cover removed. The simplicity of the circuit allows the complete oscillator with its power supply to be enclosed in a comparatively small cabinet. When the series and shunt resistors are of the same value, R, and the series and shunt condensers are of the same value, C, the frequency of oscillation of the circuit is expressed by $F = 159{,}100/RC$, where F is in cycles, R in ohms, and C is in microfarads.

A Directly Calibrated Audio Oscillator

By W. F. DAVIS,* W5GHU

The urge to build this instrument started with the two articles about the negative feedback controlled audio oscillator described by Dawley in the June and December, 1940, issues of RADIO. Some source of harmonic-free audio frequency is almost a necessity for any bridge measurements, and the other uses of such an oscillator are too numerous to mention.

My main objections to the oscillators previously described were the need of several bands to cover the audio range, and the lack of a directly calibrated dial. A little study of the fundamental circuit shows that the frequency can be varied by controlling the amount of resistance, as well as by varying the amount of capacity in the bridge circuit. Since the maximum to minimum ratio can be made much higher when using variable resistors than is easily possible with variable capacity, by using a potentiometer the audio range can be easily covered with but one dial rotation. This makes a two-gang potentiometer necessary, but this should not be any harder to arrange than a two- or four-gang condenser. This arrangement also has the advantage of spreading the calibration out over about 300 degrees of the dial rotation instead of the 180 degrees available with a conventional variable condenser. By using a large variable resistance the size of the condensers needed can be kept small enough to make using mica condensers feasible, with slightly better stability.

Since the only inputs with which I planned to use the oscillator were of the high impedance variety, an output amplifier and coupling transformer were dispensed with, and the output is taken directly from the cathode of the second tube. The inclusion of an isolating amplifier would be an excellent idea if any low impedance loads are to be used on the oscillator. Coupling and by-pass capacities should be made high enough for good low frequency response. If too many complications and additions are not made to the unit, the complete cost of the oscillator should be about fifteen dollars, cabinet, power supply and all.

Range of Frequency

The potentiometers chosen should have at least a semi-logarithmic taper. If linear resistors are used the calibration at the high-frequency end of the dial will be too crowded for use. Even the units designed for audio gain controls, as used here, leave much to be desired in the calibration curve. This can easily be seen in the front view of the oscillator by the nonlinearity of calibration at the ends of the dial. The resistance taper flattens off too much at the ends. In order to be able to use as much of the rotation as possible, fixed resistors are inserted in series with the variables to limit the upper frequency of oscillation. These can be chosen to give any upper frequency limit desired by using the formula $F = \frac{1}{2}\pi RC$, with F in cycles, R in ohms, and C in farads. The values given for the oscillator described will give a range of from 30 to 10,000 cycles.

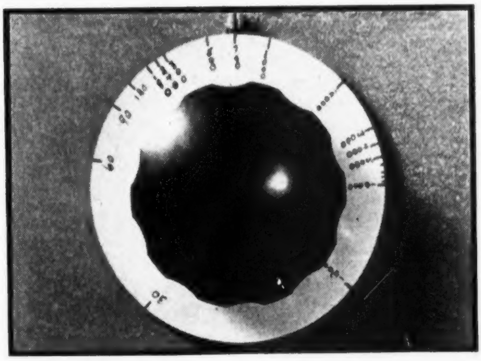
*3222 Savannah Street, El Paso, Texas.

Circuit Lineup

A 6SJ7 is used as the first tube of the oscillator, and a 6J5 as the second. Regenerative feedback is taken from the plate of the second tube and fed back to the grid of the first through the frequency determining network, R_1, R_2, R_3, and R_4, and C_1 and C_2. Negative feedback is also taken from the same place and applied to the cathode of the first tube across the two six-watt lamps. The lamps have a steep positive temperature-resistance characteristic and automatically control the amount of feedback, thus regulating the amplitude of the oscillation. If the output drops, the energy fed back drops, and the current through the lamps goes down, reducing the resistance of the lamps. Since they are a part of the feedback voltage divider, the degenerative feedback is reduced and the oscillator goes to work a little harder and brings the output back up. Due to this automatic control the output of the oscillator is essentially constant over the entire range.

Construction

Since there is not much to put in the case, it need not be very large. The one shown in the picture is 5″ high, 9″ wide, and 6″ deep. The chassis is 5″ by 9″. All the holes should be drilled before any of the parts are mounted, as drilling is likely to prove quite a job after the chassis is mounted in the cabinet. The controls and a.c. connector are mounted on the cabinet walls, and all other parts on the chassis. The dime store handles are a worthwhile addition. They make the unit a lot easier to handle while moving it around, and only add about a dime to the total cost. Panel controls include the calibrated dial, output level control, output jack, a.c. switch, and pilot light. If desired a keying jack could be added.



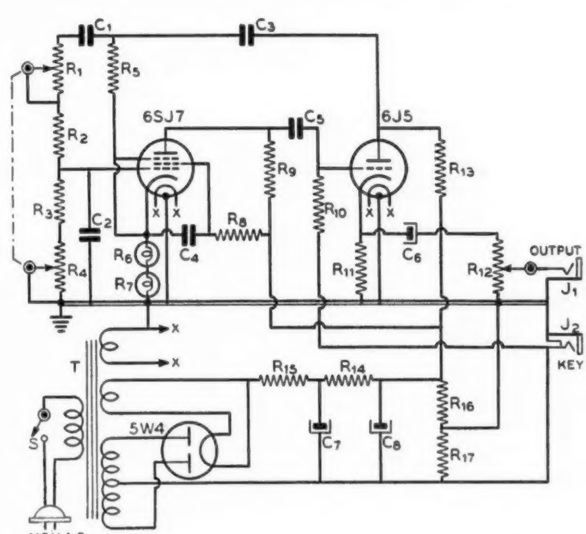
The hand drawn dial calibration for the resistance-tuned audio oscillator. Note compression and expansion of various portions of the scale as a result of the taper of the variable resistances used.

About the first thing to do in assembling the oscillator is to take the two-gang potentiometer apart and squeeze up the coupling mechanism between the two sections so there will be no backlash. This process will depend a great deal on the make of potentiometer used, but should not be very hard with any of them.

[*Continued on Page 91*]

Wiring diagram of the resistance-tuned audio oscillator.

C_1, C_2—0.01—μfd. 600-volt mica
C_3—1.0-μfd. 400-volt tubular
C_4, C_5—0.5-μfd. 400-volt tubular
C_6—10-μfd. 25-volt electrolytic
C_7, C_8—8-μfd. 450-volt electrolytic
R_1, R_4—2-gang 500,000-ohm potentiometer (Yaxley)
R_2, R_3—1250 ohms, 1 watt
R_5—2000 ohms, 1 watt
R_6, R_7—6-watt 110-volt Mazda lamps
R_8—500,000 ohms, 1 watt
R_9—100,000 ohms, 1 watt
R_{10}—500,000 ohms, 1 watt
R_{11}—1000 ohms, 1 watt
R_{12}—5000-ohm potentiometer
R_{13}—20,000 ohms, 2 watts
R_{14}—25,000 ohms, 10 watts
R_{15}—10,000 ohms, 10 watts
R_{16}—50,000 ohms, 10 watts
R_{17}—10,000 ohms, 10 watts
T—700 v. c.t., 40 ma.; 6.3 v., 0.6 a.; 5 v., 1.5 a.
J_1—Output open-circuit jack
J_2—Optional keying jack



NEW TUBES

•

RCA has announced six new receiving tubes, the 5Y3-GT/5Y3, 12SL7-GT, 12H6 and 117P7-GT, 6SS7, 12SN7-GT, and four new transmitting tubes, the 816, 8005, 931, 8001.

The Receiving Types

The 5Y3-GT/5Y3 is a full-wave, high-vacuum rectifier having the same electrical characteristics as the well-known 5Y3, which it supersedes. The new tube employs the usual "GT" tubular bulb construction and is directly usable in sockets intended for the 5Y3.

The 12SL7-GT is a new twin-triode of the high-mu ($\mu=70$), single-ended type. It has separate cathode terminals for each unit. The new tube is roughly similar in characteristics to the 6SC7. The 12SL7-GT is recommended for use in resistance-coupled circuits as a phase inverter or voltage amplifier. Due to the separate cathode connections it offers more in the way of circuit possibilities than previous dual triodes having but a single cathode terminal.

A new tube for use in receivers having a 12.6-volt heater supply is the 12H6. This tube is similar to the 6H6 except for the heater rating, which is 12.6 volts at 0.15 ampere.

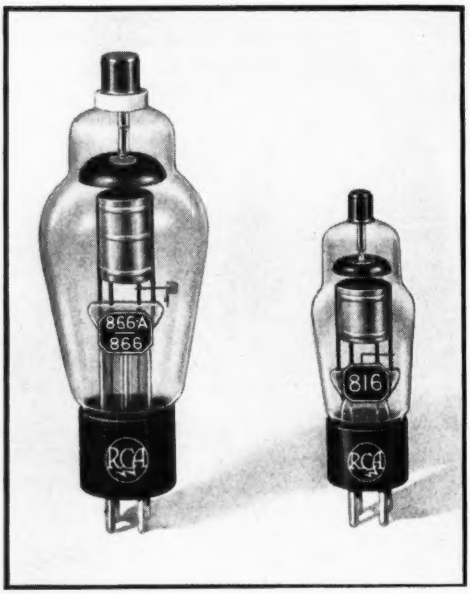
The 117P7-GT is a rectifier-beam power amplifier having a 117-volt 0.09-ampere heater. This tube is similar to the 117N7-GT except that its output capabilities are somewhat lower. The 117P7-GT will deliver 0.85 watt into a 4000-ohm load with a total harmonic distortion of 5 per cent. The normal plate current is 43 milliamperes.

6SS7

The 6SS7 is a remote cut-off r.f. amplifier pentode of the single-ended metal type having a 6.3-volt, 0.15-ampere heater. The new tube provides for a further degree of flexibility in the design of a.c./d.c. receivers using single-ended metal types, where the total voltage of 0.15-ampere types heretofore available would exceed 117 volts.

12SN7-GT

The 12SN7-GT is single-ended, twin-triode amplifier having separate cathode terminals for each triode unit. The heater requires 12.3 volts at 0.3 ampere. It is recommended for use in resistance coupled circuits as a voltage amplifier or phase inverter.



816

The 816 is a small-size, mercury-vapor rectifier for transmitting equipment not requiring the full capabilities of the type 866. The 816 has an overall length of less than 4¾ inches. An idea of its size may be had from the accompanying photo showing the 866 and 816 side by side. Ratings of the 816 are as follows:

Filament Voltage (A.C.)	2.5 Volts
Filament Current	2.0 Amperes
Peak Inverse Voltage (Max.)	5000 Volts
Peak Plate Current (Max.)	500 Ma.
Average Plate Current (Max.)	125 Ma.

[*Continued on Page* 79]

WHY EVERY AMATEUR SHOULD BE A MEMBER OF A.R.R.L.

By K. B. WARNER,* W1EH

Every radio amateur should be a member of the American Radio Relay League.

To me, the basic reasons for joining the League can be summed up as follows:

1. Amateur radio is dependent upon a strong, united organization for its existence.
2. The A.R.R.L. is the recognized national amateur organization.
3. Since every licensed amateur is interested in preserving the existence of amateur radio, he should unite with his fellows and strengthen the League by joining it.

Amateur radio is unique among hobbies in that it is perhaps the only one where a high order of social and technical responsibility is a prerequisite for participation. It is the only one that partakes of the characteristics of a public utility.

That's why there are federal statutes and a federal communications commission regulating amateur radio. That's why there is an international treaty stipulating how we can work and where.

And that's why amateur radio is so vitally dependent upon self-organization. Our present high status was not reached through any form of embryonic evolution; it was the result of organized guidance along the paths of technical and regulatory progress under democratic principles.

Amateur radio exists today in its present form not because there were a few fellows around the country who thought it would be nice to talk with each other via radio. That's the way we began, of course, but we wouldn't have lasted long if our efforts had ended there and we had remained a loosely-knit, unorganized, incoherent group. In fact, we barely lasted beyond 1912, when the first radio law came along and the legislators tried to toss the country's scattered hams into the ashcan. Oh, yes, their aim was bad and we got a break, that time—but the next time it might have been a different story.

The next time, however, the hams had an organization to fight their battles for them. That time was in 1919, just after the war had ended. Amateur radio was banned from the air, and it would probably have stayed off had it not been for Hiram Percy Maxim and the A.R.R.L.

That was the first time amateur radio's organization saved its life. There had been some skirmishes before that, in '16 and '17, and since then there have been a good many skirmishes and a few pitched battles. Space does not permit recounting these in full, but that doesn't matter; the important thing is that we were in there fighting—fighting for our lives—and we managed to survive.

And that's why I say that amateur radio is dependent upon a strong, united organization for its existence. We exist today only because we have been a strong, united, militant body. Had we not been organized we could not have survived.

For nearly three decades the A.R.R.L. has been the organized body of amateur radio. Throughout that period the League has consistently adhered to the policy "of, by and for amateur radio." It is the amateur's own association, owned and controlled by its members. From top to bottom it is an amateur organization; its members, its directors, its officers and its headquarters staff are amateurs. It has always been a *non-commercial* association. It is not sponsored or owned in any part by a commercial radio firm or publishing house. It is owned solely by its members. These members elect fifteen directors on a regional basis for two-year terms of office and the directors lay down the policies of the

*Managing Secretary, A.R.R.L.

League, determine its attitude toward proposed radio legislation, hire the paid secretary, treasurer and communications manager, who give their full time to amateur radio. The directors themselves receive no salary, nor do the president and vice-president. In fact, to ensure that the League shall always be an amateur organization, without commercial taint, its constitution specifies that no one engaged in the sale, rental or manufacture of radio apparatus or literature can be a director.

The A.R.R.L. today is recognized as the official spokesman for amateurs and amateur radio in the United States and Canada. Its recommendations usually form the basis for amateur regulations promulgated by our government authorities. The A.R.R.L. is frequently consulted by the Federal Communications Commission in the formulation of regulations pertaining to amateurs, and it represents amateurs at all international conferences affecting amateur radio. The President of the League is chairman of the Amateur Radio Committee of the new Defense Communications Board.

There are many thousands of radio stations of various classes now on the air, and more are constantly being added. The competition for space on the air among the various services is intense. This competition—the necessity for every *class* of station to demonstrate that it is operated in the maximum of public interest, convenience and necessity—forces amateur radio, through the A.R.R.L., to maintain a united front in order to preserve its rights.

Nor does the job of preservation mean only going into the Halls of Congress or the offices of the F.C.C. and talking amateur radio. In fact, that's not even the most important part of it. More important still is the job of building the ham fraternity into a public service institution so valuable to this nation that no man can say with logic or justice that our activities can be questioned or should be curtailed.

For nearly three decades the A.R.R.L. has been building that kind of organization into amateur radio. Under the inspired leadership of Hiram Percy Maxim—and in recent years Dr. E. C. Woodruff and George W. Bailey—we at the League headquarters have been guiding the organization along lines of maximum public good in accordance with the policies set forth by an alert Board of Directors elected by free choice of the membership on a geographic basis.

These days are showing the farsighted wisdom of those policies. These are the most critical times we have ever faced. We have two responsibilities: one to keep amateur radio on the air, its privileges intact short only of restrictions vital to national defense; the other, to stand shoulder to shoulder and work in concert with the various government agencies to ensure that we can be of maximum aid to the national effort.

We have been on the job. We are on the job now. We are in very frequent attendance in Washington on behalf of these matters. Some forty visits to official Washington were made by A.R.R.L. officials (apart from the work of the General Counsel of the League, whose office is there) during the sixteen months following the outbreak of war.

At its annual meeting in May, 1940, the A.R.R.L. Board of Directors appointed the president of the League an extraordinary committee of one with full power to act in preserving amateur rights during the emergency situation and set up a special Defense Fund of $10,000 for this purpose. The meeting this year reaffirmed these grants.

By the following steps, the League has progressively protected the rights of amateurs on the air in the present emergency:

1. It inaugurated the A.R.R.L. Neutrality Code, which was largely instrumental in avoiding a shutdown in the autumn of 1939 through official desire to avoid endangering neutrality.
2. It undertook an expanded internal policing program to guard against illegal operation under cover of pseudo-amateur status, thus avoiding possible severe restrictive regulation.
3. It offered the services of amateur radio as a body to the various governmental agencies.
4. Its representatives conferred with federal officials during the May-June 1940 crisis to arrange minimum regulatory restrictions in connection with the new "non-belligerent" phase of U. S. war participation. (F.C.C. Order No. 72.)
5. It secured exception for the 1940 and 1941 A.R.R.L. Field Day tests under the portable ban ordered last summer. (Orders Nos. 73 and 73-D.)
6. It secured exception for ultra-high-frequency mobile operation under the portable ban. (Order No. 73.)
7. It secured a special ruling allowing portable-mobile operation during emergencies and on weekends for testing of emergency gear. (Order No. 73-A.)
8. It secured a special ruling covering temporary fixed-station operation under portable status. (Order No. 73-A.)
9. It inaugurated the A.R.R.L. Code Proficiency Program, designed to raise the general level of amateur code ability and thereby increase the value of amateur radio to the nation as a reserve of trained operators.

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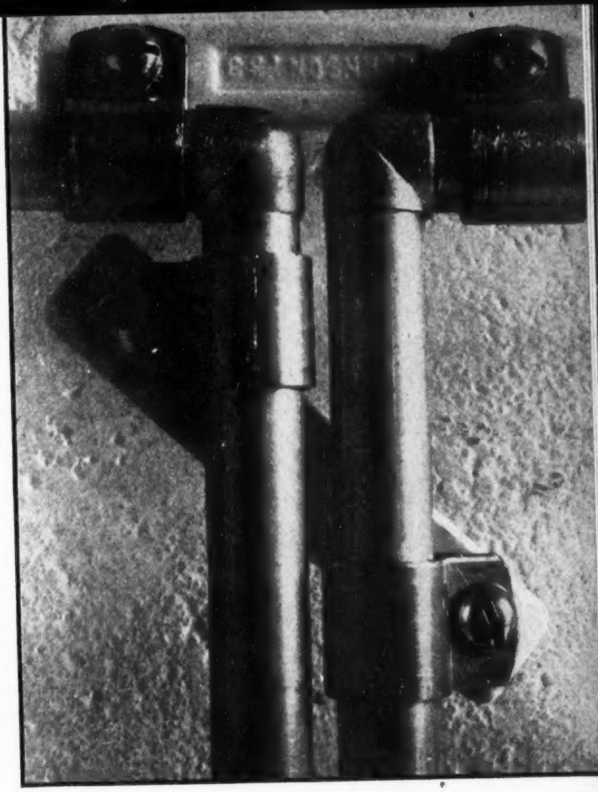
● Showing the rather neat method of accurately spacing Q bars used by W9CCY, Council Bluffs, Iowa.



DEPARTMENTS

- **X-DX**
- **U. H. F.**
- **Amateur Stations**
- **With the Experimenter**
- **Yarn of the Month**
- **The Amateur Newcomer**
- **What's New in Radio**
- **Open Forum**
- **New Books and Catalogues**

X-DX AND OVERSEAS NEWS

By Herb Becker, W6QD

Send all contributions to Radio, attention DX Editor
1300 Kenwood Road, Santa Barbara, Calif.

The mail pouch for this month is rather deflated but there are a few choice bits of information which I hope will prove of interest to you fellows. As one of my "pals" said, when I told him I was running out of material, "Heck, you'll always be able to ramble along even though you don't say anything." So, with that little snatch of a quotation for the general theme this month I'll see how well I can live up to it. Here goes . . . . get out your dark glasses.

First out of the bag this month I've grabbed a letter from Harold Simmons, ON4HS. Harold has been one of our most consistent contributors, and we think this is swell when you know he's in the midst of things in England. It was just a little over a year ago that ON4HS left Belgium with his family and made his way down through France and to the coast. From there they managed to grab a small freighter and arrived in England safe and sound. En route through France they were forced to leave their automobile and a few other large items in order not to hold up traffic on the crowded roads. Here's the letter written in April, 1941.

"Dear Herb:

It is now some months since I wrote you last, in June 1940, to be correct. I have received all numbers of RADIO except November and December, which probably went down. All the others arrive about six weeks late.

For your information, I am now on the Engineering staff of the B.B.C. which I joined last October, and like the job very much. There are other hams at my station, G2MV, G2IG, G2VZ and others. We get on very well together and the work is real ham work only on a bigger scale, the work being of National importance. The station where I am working (cannot give address, sorri) was photographed by *Life* a short time ago so you may have seen the pictures in that journal. If not yet, then you should very soon, and you will see where 4HS hangs out.

One thing I can tell you, Herb, is that we are all in the firing line and have got so used to it now that we take but little notice of it all. We carry on our jobs by day and by night, even though old Hitler's cowards are above us hiding high up in that dark sky. Funny how old Nasty dropped his mass daylight raiding; it makes one reflect he cannot be so certain of his famous Luftwaft after all . . . or is it that he knows our men are streets ahead of his gang of FORCED men?? Just one example of how the ordinary folk, and that includes women and children, despise this bombing, Herb. The other afternoon my wife was out shopping in the town when a big Dornier bomber came down out of the clouds and began to spray the streets with machine gun fire. This was on a "hit and run" type of raid, which is all these louts are capable of just now, so feared are they of our 'Spitfeureurs'. Do you think the shoppers ran for cover? No, they simply poured out of the shops to shake their fists at the blighter, as he was only about a thousand feet high. Then the rotter laid his beastly eggs and even then the people did not run for cover; they stood still and counted the bombs as they left the plane, then most of them stepped into nearby doorways to escape the blast. After this they went on with their shopping as if nothing had happened, giving a hearty cheer to the Spitfire which appeared out of nowhere and chased the Bosche out to sea. That is how Britain is standing up to that bully Hitler, so you can tell the lads that they need not fear that bombing will ever bring Britain to her knees. Quite the opposite, Herb, o.m.

I am sure that you lads in America know that we can take it over here, and remember also, that we can give it, as old Nasty is finding to his cost just now. The pity is that our M.O.I. will not allow papers to publish some of the fine RAF pictures showing Berlin burning. Why, I do not know; unless they think we do not need bucking up. Some day I guess we will be pestered with them, however.

So much for the war. What we hams are mostly thinking of is *the* day when this rotten thing is over and we can *all* get back to our junk boxes and think out some fresh rigs for the DX competitions in store. Boy, what a grand day that will be for many thousands, so you must keep the flag flying from your end in the meantime and not let things slide. Please tell the boys I would like to hear from them and they can write to the address below. Tell them to keep the ball rolling until our hands are free once again to join in the fun. If you boys do not keep the bands going, we over here feel the whole thing will flop, because the ham bands are so rarely used. Then it would be too bad for all of us.

That's the lot for now, Herb, o.m. You shall hear from me again.

Sincerely,
Harold Simmons, ex-ON4HS
'Dunara',
Bridgeway,
Selsey, Sussex,
ENGLAND."

KD4HOC, New Station on Swan Island

W6SA reports working another station on Swan, signing KD4HOC. Apparently this is OK because in a recent letter from George

Grover KD4HHS, he remarked something about a new operator and station there soon. HOC has been using about the same frequencies that HHS uses. This should give a double opportunity to work Swan, for those who need the country. While talking about Swan Island, KD4HHS has sent us a list covering contacts from February 17 to April 25.

Hams in the Service

W8QN, Fred Collins, can be reached at the U.S.S. Saratoga, based at San Diego. W6RDN, Bill Cattrell is on the same ship. At the Mare Island Navy Yard some of the U.S.N. Reserve Officers on duty as communication officers include, Lt. j.g. C. R. Concannon, W6RQ, Lt. j.g. J. Geritz, W6CTX, Ensign J. R. Wells, W6QL, Ensign M. F. Doss, W6ICU, Ensign R. Hanson, W6AGQ, Ensign J. H. Ludeman, W6BHR. At Fort Douglas, Utah, is Al Farries, W6OOU, who takes exception to my crack in the May column, that Washington, D.C., has 2.8 girls to every man. He says you should see Salt Lake City. W6RYA is on the U.S.S. Mugford at Pearl Harbor. They call him the "Mug from Mugford." Anyway, RYA gives some info on some of the boys in their division . . . . W6SAQ is experimenting with u.h.f. W9PGA wants to work sked with Nebraska . . . . W9UEX expects to have station going on beach before long. W6RYA looking for stray r.f (Hula girls). W9ZMP is assisting 6RYA. W6MSW is tearing up ship receivers and making amplifiers out of them. They have a seaman aboard whose name is H. Ham, but he is not a ham. Also says whenever they go to sea for a few days, 9UEX, 9ZMP, 9PGA, 6MSW disappear for a few days, when the wx gets rough. They certainly look thin when they return, he says, and then adds that soon 9ZMP will be able to take it ok, then he will miss that extra piece of pie that he gets for dinner.

It is swell hearing from ol' W1HE again. It has been a long time since we have heard that sig of his. Gathering from what he has been doing of late, I'd say he will be back in there pushing the key before long. Wally said that he went to a local Hamfest recently with W1AQT (and I know what that means) and W1PH. Says the 'fest was just beyond Wellesley College (none of the college gals were there) and they all had a good time bowling and bending. 1PH won a soldering iron and 1HE, a Radio Handbook. Now that I've gotten in that plug I'll quit.

W2GW lets us read part of a letter from Roger Parnell, ex-KE6SRA. Here goes:

"I left Johnston Island about five months ago and returned to Honolulu, spending about two months there, then leaving for Wake. I have a hot KC6SRA call all ready to cut loose with, but to date I haven't been able to secure permission to open up. If things get a little better in the next month or so I will probably see you on the air again. You might pass the word along to the boys and then tell them to keep their fingers crossed . . . . or contact your Senator and get them to lift the silence down here. Also I will answer all QSL's, one way or another from Wake, to any of the boys who failed to receive one. Best of luck and regards to all hands. I'm listening to youall from KING EASY NUMBER SIX SAIL ROGER AFIRM SLANT KING CAST SIX FIXED PORTABLE. (hi). Roger M. Parnell, KE6SRA/KC6."

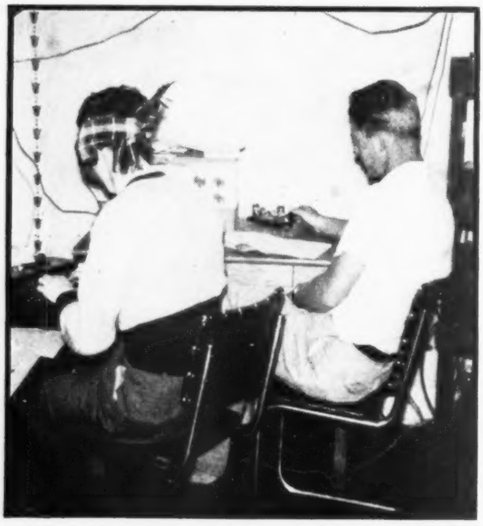
Walt, W2GW goes on to say that he has taken up roller skating, and the Plainfield Club is going to sponsor a Hamfest on wheels, (roller skates) to raise funds for field day. He says it should be a 3-ring circus when you think of a flock of hams on skates after they have tucked a few under their belts.

K7BC, Sitka, Alaska

X-DX is surely glad to hear from Ed Stevens again, even though he is up in Sitka, Alaska. Ed, K7BC, has been very active lately and will give anyone a K7 contact, as he is on almost every night. Ed says the first night

on 7 Mc. he worked all districts so figures it is a fair location. He works on 7002, 7012 and 7167 kc. also on corresponding 14 Mc. frequencies. Antenna is a half-wave job with zepp center feed. QTH is one that stands about 100 feet above the rest of the little village, and he has a couple of 60 foot sticks that are honeys. Receiver is an SX-24, as can be seen in the photo. Transmitter lineup is as follows: 6F6G osc., 807 buffer, p.p. 35 T's in the final running a little over 500 watts. Notice the cards on the wall of Ed's shack. No, he didn't work them from this location . . . . but he can show you a bushel basket of them which he accumulated while pounding brass at his W7BB station years ago.

W9SZB really goes after his 40 w.p.m. copying on the mill seriously. He believes in the touch system to the last word. Just to prove he can take it and put it down via the mill, the photo on this page shows him blindfolded. W9ZDB is dishing it out on the bug on the right. The blindfold looks like a Apache shawl . . . . or maybe Apaches don't have shawls . . . . but if they did, it looks like one.



W9SZB on left, W9ZDB on right.

A line from K6CGK shows he is more than active. He does a bit of brasspounding and microphone juggling at K6TKA, which is the Kauai High School. Kay needs only cards from KC4USA and KB4HBX for all WAAP confirmations.

A recent trip to the S. F. Bay area brought out a lot of funny things. So many of the gang are trying their best to slide out one end of the spectrum of bands or the other. A survey made by our Operative No. 1492 revealed that many are slipping down to 2½ or 1¼ meters, while another group have sky-rocketed up to the 160-meter band. 'Tis a very strange sound, indeed, to hear all these calls that used to be hard fisted, or heavy throated dx men. The payoff was when a certain two letter call was bragging about his 2½ meter dx. I only got in on part of it and thought he was talking about the good ol' days . . . . but no, he had just worked some guy in Sacramento getting an R9 report. And to think it wasn't so long ago he thought nothing of working a mess of Europeans every night . . . . and a new country every week or so. Further snooping around up there brought out the news that W6HB has a new kw. rig about ready to fire up on 20, 40, and 80. He hasn't joined the u.h.f. gang . . . . yet.

Something Not to Try

A bunch of us got many laughs out of a certain little incident that happened locally recently. It seems that a certain hotel utilizes the worth of the photo-electric cell to open the doors to their cocktail lounge. An occasion arose whereby it was necessary to go through this said door. Well, the fun began when this "certain" ham had to light a cigarette as he passed the light beam of the cell. By nonchalantly holding the match close to the cell a very funny thing occurred; the door did not close. We waited and waited but it did not close. Soon all the employees in the place were curious and stood around with their mouths wide open . . . . they couldn't even pull it closed. They called the Manager . . . . he called the hotel engineer . . . . they fiddled and fussed and stood around and looked . . . . and scratched their heads. The punch line of this story is . . . . when all of them stood in apparent bewilderment . . . . the darn door closed very nicely all by itself. My bet is they still haven't doped it out. There, my fine friends, is something not to do in your spare time, but if you must I'd consult W6SA for details.

Before I forget it again . . . . Doc Westervelt now has his old W9 call . . . . W9LKH . . . . again. He had K6QYI but sounded a bit out of place in Rockford, Ill.

This is the last issue of RADIO before the summer layoff. I hope that I may gather enough material . . . . scandal and otherwise . . . . while on our trip through the east. I never thought it would come to pass where I would have to journey out to gather news as well as to snap a flock of pictures for the column. Better keep those keyholes plugged lest I get some pix you don't know about. The

[Continued on Page 79]

U. H. F. . . .

By JOSEPHINE CONKLIN,* W9SLG/3

Oh yes, the Merry Month of May came right on schedule, bringing quite a few days of five meter dx. Reports are rare from the east, but the rest of the boys have done all right.

Vince Dawson, W9ZJB, took a message from Chicago, relayed in the April field day by ground wave to Kansas City, and handed it to W6ANN on Sunday, April 27. It is too bad that the messages did not get through all the way from the east coast. ZJB worked W6MXX, also near Los Angeles, and heard W6QAQ in San Francisco. This appears to be the usual Sporadic-*E* layer skip, possibly helped by a little low-atmosphere bending at the ends. Neither end reported any ten meter signals during the contacts, which seems to be unusual. ZJB says that W6ANN was R9 with a fade and boom in the background like W6's have on ten meters when heard in Kansas City. Vince had not heard a ten meter signal for two weeks.

On May 7, W5AJG was awaiting the start of the new season, calling without result, and listening to the best ten meter short skip in several months. Some of the boys had said that five opened in the east. While finishing a letter to this column, at 5:20 p.m., the band did open and AJG raised W8QQP QQS FHA and heard W8MYZ. Not an impressive opening, but a start.

The way W8QQS explains the May 7 opening, he does not get in on much dx in Saginaw, Michigan, being too far east or west. He got W5AJG after hearing his "rockcrushing i.c.w. pounding through."

A letter from Jim Brannin, W6OVK, said on the 10th that there had been short skip on ten meters for the previous two days while he was laid up with a cold, although W6QLZ heard three districts during the day. Apparently this refers to the 10th, not to any reports on the 8th or 9th. However, on the 9th W9NLR and W9ZQC in Brookings, South Dakota, heard an A2 signal on about 57 Mc. calling "CQ five" but it faded out before signing.

May 10

On May 10, W8QQS was again rewarded with a contact with W5AJG. Then he heard the five meter harmonic of W9QPK as he did last year, concluding that the absence of other W9 signals (many may have been too close) indicated a lack of morale. Then QQS heard Mims, W5BDB, in a local contact with W5DXW and was surprised to find them not to be harmonics when DXW answered a CQ, starting a three-way QSO. Next, W5HTZ was worked but QQS must have been buried under a flood of W2-3 signals. His luck was not over, for QQS found W6ANN calling CQ on i.c.w. at 7:59 p.m. Eastern time and after making a W9 contact, ANN came back to a call, gasping out on phone, "For heaven's sake stay on c.w.; I may lose you!"

The above was hardly representative of the type of thing that was going on around the country on five meters at the time. Here is one comment: "Bet ole Mims, W5BDB, is a nervous wreck tonight. He was right in the middle of the thick skip and worked a jillion of them. Bet he never goes back to 20. He might as well produce a Signal Squirter for five, but it won't 'Put your signal where you want it when you want it there'—no sir, not with this screwy five meter stuff."

In Dallas, W5AJG said, "The W1's and

Photo sent in by W6OVK, Tucson, Arizona, showing some of the W6 u.h.f. dx gang. From left to right, they are: W6QAP, W6OWX, W6HL, W6OIN, W6OVK, and W6PCB.

*300 Wilson Lane, Bethesda, Maryland.

W8's were coming in along with W6's in California. W1HDQ was putting in a 10 db above R9 signal with no fade whatsoever, steady as a rock, while W6's in California were fading fast. . . . Such signals I've never heard from the first district, even in 1939. The W1's stayed in over two hours; and the rest of the time between 5 and 11 p.m. Central time, when the skip came in, the W8's were there. The Oklahoma and Arkansas stations would seem to be working but when the skip pulled over into Texas, Boy, what signals. Then out it would go although I could hear the signals weakly and couldn't work a thing." That sounds like the Sporadic-E layer was not strong enough at some points to maintain good signals for the whole period. AJG worked W1AEP KLJ HDQ W3BKB W6QG (Calif) OVK W8QQS QQP CIR QXV QDU DDO KKD RFW RKE KQC TIU TBN JLQ LRE AZZ FXM UOS W9QCY AKF. He heard numerous others who were not worked.

In Texarkana, Texas, W5DXW worked six districts and ten states including these: W1HDQ KLJ W2BYM DDV W3GUF CGV DI HFY W5BDB ML W6QLZ OVK SLO W8QQS FGV GGH RNP QXV CIR. The band opened at 6 o'clock for W8, rapidly going to W3 and W2 in addition. At 7:15 it opened to W6 for 15 minutes, then back northeast. At 7:40, W1 came in with W2-3-8. At eight, it opened west for 45 minutes with W8-3 still in. He left then, later finding that it was open again at 9:30 for W8 and weak W9's for a short while. Most signals were quite strong and steady.

Jim, W6OVK, said: "Boy, it was a dinger yesterday evening on 5." He heard some swish and buzz during a contact with W6QLZ and picked up W5DXW at 5:35 p.m. for the start of a four hour opening. Then he hooked W3IIS BVB W9NFM, all reaching R9 plus, but fading was severe at times. He stopped to eat supper and water the lawn, his wife not understanding the horror of those chores when the band is open, and returned to work W5DXB AJG DXW BDB W9CJS ZQC FZN. At 8:23 he turned the beam 20 degrees north of west, working W7ERA CIL. W6SLO got on late to raise W5DXB DXW BDB W7ERA W9YKX. Most of the other locals were off except W6QAP who was having some trouble with the 6L6 doubler he was using on c.w. into a temporary antenna. No. W1-4 were heard at OVK but W2CUD and W3's were in there working each other, mostly not identified. OVK used c.w. on his CQ's which netted him a W3 and W9 that he thinks that he would not have worked otherwise. He found the W6QLZ beam broad enough—working South Dakota to Louisiana at one setting— which is quite normal for loud signals. W6OVK called K6MVV through an arrangement made by W6PCB on ten meters, but nothing was reported.

W6QLZ worked less but heard more in the four hour opening, hooking W5DXW W9ZJB USI ZQC CJS AZE (Minnesota) YKX FZN and hearing W1KLJ W3?UF (C, G. D or E) W3??L (about 56.1 near W1KLJ) W5AJG BDB AFX W8CIR OKC QXV W9DYH.

In Milwaukee, Oregon, W7ERA had just finished putting up a new "W6QLZ four element beam" when he heard W6OVK in Tucson at 7:43 p.m. Pacific time and worked him followed by W6SLO. After that, Walt said, "Boy, what a band; it's the one and only for me." With the relatively few dx contacts that W7's have, he may need a lot of that enthusiasm.

W9NLR's letter, reporting on joint operations with W9ZQC in South Dakota, states that W6ANN came through from 7:15 to 9:45 p.m. Central time, while W6QG lasted from 7:23 to 10:12. They worked W6QLZ OVK ANN QG and heard W6QUK(?) W9BDL. It looks like the skip was all southwest of Brookings except for the W9BDL contact, with nothing more to the east or south, so that the

Another'n. This one goes with W9ZQC/NLR, Brookings, S.D. It is delta matched similar to the W6QLZ/OVK type.

W5AJG, Dallas, Texas, at the operating position copying some 56-Mc. dx.

W5's and eastern stations did not get through.

W9PK near Chicago, Illinois, says that he worked W4MV and W4FPM on the 10th, the only report of W4's received here, and the only one of a station working dx that did not get in on any of the W1-2-3-5-6-7-8-9 work! That means that every district participated in dx work on one evening, to some extent.

Results at W9YKX in Iowa were similar to those at ZQC two hundred miles northwest. YKX worked W6ANN SLO QLZ in a very spotty opening. Bill must have been too far north to hear the eastern and southern districts.

May 11

After the big opening, anything would be a let-down. Between 9 and 11 a.m. Central time on the 11th, W5AJG worked W6QG and heard W6ANN W9CJS. Between the same hours but in Mountain time, W6QLZ worked W5HTZ W9NFM IFB and heard "Mrs. W5AJG." About noon Eastern time, W8TIU in Michigan heard W6ANN weekly on phone working a W9. W9PK in Illinois may have been the one, for he worked ANN on the 11th and heard W7IFL for an hour. W9YKX in Iowa missed out on the two-hop stuff but worked W5CHG. Likewise, W9NLR ZQC in South Dakota found only W5HYT HTZ AFX whom they worked and W5WX CHG W8NYD (Pittsburgh) whom they heard in the morning; but they had their eyes on the possibility of a further opening when at 2:40 they heard W7GBI on ten meters signing with a W5 and saying that he was looking for W6QLZ or someone else. They gave out a call on five, heard no more on ten and listened on five where GBI was calling them, coming in R9. A long distance phone call to W9CJS got him a contact too at about 3:20.

W7ACD was also listening on five the Sunday of May 11, and although his transmitter was on ten he succeeded in working W9ARN and W9NFM crossband. In addition to these two he heard W5AJG W5AFX W9USI W9ZHP and W9IFB. W5WX says that the band opened in Amarillo at about 10 a.m. on the morning of the 11th. W5HYT was first to find the band open and he called the other two stations who operate on five, W5WX and W5CHG. All three stations then went on the band and started working some of the stations coming through. The band lasted about one hour when it went out as suddenly as it came in. W5HYT on 57.2 Mc. worked W6QG W9USI ZQC CJS. W5CHG on 57.04 Mc. worked W9USI YKX W6QG. W5WX on 57.23 Mc. worked W9USI and W9CJS. Also heard by all three of the stations but not worked were: W9ZHB W8RKE W6ANN and W6QLZ.

They heard nothing on May 12 during short skip on ten, but others were more fortunate. From noon to 1:30, W5AJG worked W6QLZ W9DWU DYH during a good but spotty opening with signals in for five minutes and out as long. W5AAN at the Texas State College for Women, Denton, worked the same three. W6QLZ raised W5AJG AAN NFM DWU.

Although there is no exceptionally large number of reports for May 14, W6QLZ says that the band was open all day for him while he hooked W9YKX NFM UTZ QPK KZP CCY and logged W5HTZ BDB W9HAQ and another W9 in Iowa on about 57.7 megacycles. W6OVK says that his opening was from 5:30 to 9 p.m. in which he raised the same ones as QLZ except for W9KZP, and heard W5HTZ

BDB W9GHW and several not identified. One was a fast commercial on about 57.7. Signals were good until the last part when fading started. All were R9 except W9UTZ who faded between R8 and R4. W6SLO got on late but connected with W9NFM CCY. W6QAP on c.w. hooked W9CCY YKX. The Iowa boys seems to have gathered in a lot of W6 contacts that night; W9YKX said that he got W6OVK QAP ANN in Arizona and California.

A short opening during widespread ten meter skip on May 16 brought contacts with W9UTZ NFM for W6OVK, with no other reports that evening. On the 18th, W6QAP and SLO heard W5VV for an hour without making contact.

Something more spectacular happened on the 19th at W6OVK when he started a four hour opening by working W6QG, for a very short hop, at 5:40 p.m. He also had contacts with W7HEA FDJ FFE CIL and four with W7ERA. W6QG was fading rapidly up to R7, difficult to read. The W7's were against the pin on the R-meter for two hours, fading badly for the last hour. Commercial c.w. harmonics and ten meter phone harmonics from California and W7 came through all evening. W6QAP heard an R9 NBC broadcast from California on 55,800 kc. Ten meters was open to W6, W7 and K6 with a few weak W5's. W6SLO got W7ERA and heard a harmonic of W6QAY(?) in Nevada.

Again on the next night, the 20th, W6OVK worked W5FSC and heard W5DXW BDB AJG, who were all working each other and W5AAN in Denton on ground wave. W6SLO OVK tried to break in for an hour without success.

Aurora-Type DX

Up to the time of writing, there has been no report to this column of recurring aurora dx following March 1 and 30 by a 27 or 28 day interval. However, W9NLR ZQC had visible aurora on April 24, during which a fluttering signal was heard on about 56.1 megacycles that could not be identified because it was modulated rather than keyed. These boys were also in on the March 30 dx; having noticed the nature of ten meter signals, they dropped down to five to work W9ARN near Peoria, Illinois, followed by W9DWU at Minneapolis, and W9NFM in Iowa. They also heard W9HAQ in Davenport and W9RGH in Peoria.

Additional comments on these storms was received from the Department of Terrestrial Magnetism, Carnegie Institution. It was said that there is no recurrence of bad storms but small storms come back periodically. Last month it was pointed out that the aurora-type dx seems to have been more likely with the smaller storms, so the 27 or 28 day cycle may apply for a few months. It was pointed out that magnetic storms are more predictable during the decline of the sunspot cycle. An improved index has been provided which, it is hoped, will be studied this summer to see if it will be helpful to predict dx of this type.

So far, it looks like the National Bureau of Standards may be right about Sporadic-E layer skip tending to continue rather than to fall off with the sunspot cycle. There seem to be changes, however, with more real long distance work, a few cases of very short hops, but unless it is just a case of failure to report, the W1-W9 type of work has not appeared up to the middle of May when it is about due for its annual opening.

Antenna Data

A few outstanding stations have been asked to provide exact antenna data, to give a starting point for the tuning of beams. W1DEI says that several Boston hams tried that and got nowhere. Knowing that each beam should be tuned on the spot, W9YKX usually says to start out with 8′ 1½″ for the radiator, 8′ 5″ for the reflector and 7′ 7″ for the director, for his 4′ 2½″ spacing and Q bars of the same length. The rods are spaced as closely as Johnson spreaders will go when matching a 1½″ line of no. 14 wire. W9CCY mounts the spacers diagonally in order to get the rods closer together. W9YKX hears W9CCY in Council Bluffs (down in the valley?) R9 all the time now that they both have beams, but still Bill thinks that 80 or 100 feet of height to get clear of trees and things would go a long way to solve anyone's extended ground wave dx problems, if the fellow has a good receiver.

W9ZJB and VWU used verticals in the past to work between Kansas City and Topeka. Now they both have horizontal arrays and get through 20 db above R9, some of which should be attributed to ZJB's new location, possibly all of the rest to beams rather than the polarization.

Although the verticals tried have not been by any means unusually good ones, the 5 and 2½ meter crossband contacts of W6OVK and W6QLZ at 107 miles have been possible only on horizontals. No one is trying to say that verticals are no good, but it all does show that a little experimenting may help a lot so far as antennas are concerned.

Coaxial Tuned Receivers

A letter from W9AOB/2, Box 153, Middletown, New Jersey, indicates that Dave is now

working in the Army's experimental laboratory at Fort Monmouth, New Jersey. He reports that W9TAK has a very nice concentric line superregen on 112 megacycles, using a 7A4 detector but otherwise like W9AOB's with separate quench and no r.f. stage. Dave says that it works better than any other he has tried. Dave's uses an HY615 detector, 6C5 quench, 6F6 audio. The concentric line is made from a French 75 mm. shell case (3 inch) with a small inner conductor of 3/8-inch tubing. He says that this is still rather broad and that a larger inner conductor should be preferred for higher Q. Actually, the tube loads the line badly when it draws grid current, so the grid should be tapped way down on the inner conductor or an r.f. stage relied upon for selectivity. However, his superregen is sensitive, with low noise and hiss levels.

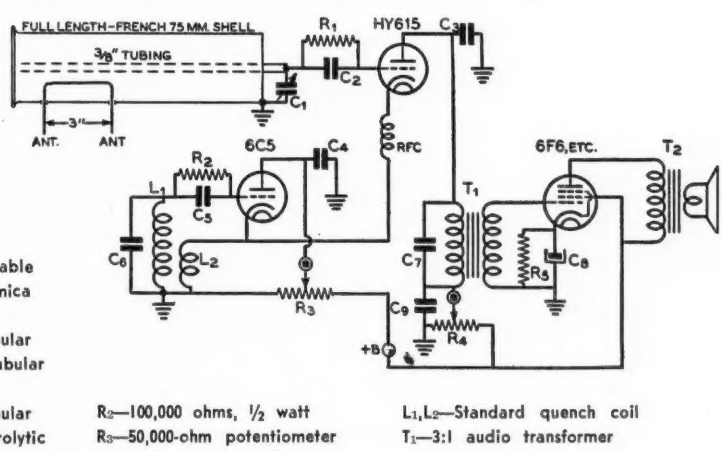
W9YDC in Omaha has built up a coaxial line tuned converter, with the encouragement of W9YKX. It has nickel plated pipes, acorn r.f., and 6K8 mixer. At last report, it was working nicely. YKX rebuilt his with an acorn mixer, getting less noise and more sensitivity that is helpful on long ground wave work, pulling in W9ZJB and W9NFM over 200 miles away with strengths that sometimes get up to R9. The r.f. stage oscillates in some parts of the band, however, unless the screen is supplied by battery. He may have to use a choke and resistors, in series with the screen lead, each by-passed, to get out the r.f. Usually, the poor by-passes can be located by taking off the antenna, tuning in a local oscillator, and touching each supposedly cold socket terminal with a screw driver. If one is hot, the signal will be louder when the screw-driver "antenna" touches it. This works on concentric line circuits that are reasonably well shielded. One such set had the acorn socket on the wrong side of the shield, so that the plate rather than the grid went through the hole, with the result that oscillation was bad unless antenna loading was made very great.

Miscellany

Those who like modulation on their c.w. signals might introduce a little audio into the cathode lead of the crystal or other oscillator, even if it is followed by doublers. The resulting phase modulation can be picked up by a.m. or f.m. receivers.

Recently, W4CYU/3 came from Florida to Washington to take a civilian job in the Navy Department. He and Rush Drake, W7ESK/3, found where all the hilltops were in nearby Virginia and went around looking for one that had a house on it where a boarder would be taken in. They found one with basement space for a rig and a field for antennas. All of which suggests that the way for a ham to locate is to start with the study of locations on a contour map, then to try all of the good spots.

This column will be anxious to receive letters from the gang all summer, with pictures too, in order to bring a good summary of u.h.f. conditions in the first fall issue. The next deadline for the column will probably be August 15, but don't hold off until then!



The W9AOB 112-Mc. concentric-line superregenerative receiver.

C_1—15-μμfd. midget variable
C_2—.00005-μfd. midget mica
C_3—0.002-μfd. mica
C_4—0.5-μfd. 400-volt tubular
C_5—0.01-μfd. 400-volt tubular
C_6—0.002-μfd. mica
C_7—0.01-μfd 400-volt tubular
C_8—10-μfd. 25-volt electrolytic
C_9—0.5-μfd. 400-volt tubular
R_1—1.0 megohm, 1/2 watt
R_2—100,000 ohms, 1/2 watt
R_3—50,000-ohm potentiometer
R_4—50,000-ohm potentiometer
R_5—400 ohms, 100 watts
L_1,L_2—Standard quench coil
T_1—3:1 audio transformer
T_2—Output to voice coil
FRC—U.h.f. choke

56 Megacycle Notes

W1DEI/3 is on the air again in Washington. Mel is one of the many hams at the Naval Research Laboratory. His brother W1QB, worked another state recently—Oklahoma.

Finally, W5AJG in Dallas heard W5VV in Austin. Leroy telephoned Wilmer to ask him to listen, but only an R1 signal could be picked up the other way. Then a few days later they made the first contact over the 200 mile path. Leroy thinks that he is a little too distant to use VV's signal to tune up the equipment on the head. He is working W5AAN regularly, 45 miles away, and reports hearing the gang at Texarkana, Arkansas, 165 miles away. The contact was actually made shortly therefater. AJG has his 300 watt rig going now on a four element horizontal *Q* beam. Also, he has a 25 watt mobile job (described elsewhere in this issue. Ed.).

At the Texas State College for Women, W5AAN uses 150 watts on a pair of HK24's in the final. The antenna is a three element closely spaced beam 65 feet high, using auto whips for elements. On May 18, AAN got through to W5BDB in Texarkana. AJG worked DXW that night, and AAN also hooked W5HTZ in Cromwell, Oklahoma. AAN also works W5AJG EHM EYZ ATH JCN/5 "locally."

On the Texas side of the Arkansas line, W5DXW uses 225 watts and a six element horizontal. His converter line-up is 1232-7Q7-7A4.

At last word, W5DNN was working hard for his first skip contact using a four element W6QLZ beam similar to W5VV's. He has a converter as described in *QST* for February, and puts 50 watts into his transmitter final.

Wilmer Allison, W5VV, says that his commission finally came through so he may soon join the Washington gang. VV was using a kilowatt and a beam when AJG heard him. Subsequent tests failed for a few days before the first contact, so it was probably by low atmosphere bending, and not of the consistent sort that the Missouri-Iowa-Illinois gang seem to be getting.

W6OVK says that W6QLZ's signal on five meters was down in March and early April, then it came up to R9 again. OVK uses two 7V7's as r.f. stages, 1232 mixer and 6C5 oscillator in this five meter converter. This one works better than the 6K7GTX-6K8GTX job that he sold.

Another Tucson station, W6QAP, is now using 25 watts into an 809, and is constructing a beam.

In Oregon, W7ERA has been working W6's mostly. He has another of these "W6QLZ four element beams," feeding it with a 100TH taking 200 watts. The receiver is an Ultra-skyrider preceded by 1852 r.f. and 6K8GTX converter stages.

W8OAP is at the WBTA transmitter in Batavia, New York, between Buffalo and Rochester where he hopes to be in a good spot to relay 56 and 112 megacycle signals between the two cities. His transmitter has a 6V6G crystal stage, 6L6 multiplier and 807 final running straight through on 56,304 and doubling to approximately 113,920.

W9IZQ of Milwaukee, Wisconsin, has been called to active duty in the Naval Reserve, and will go to a communication school before getting sea duty.

W9NLR says that W9USI moved again and has not put up his beam but works dx on the *Q* section! NLR and ZQC seem to have gone into a cooperative venture, having put up a beam. Most of their local contacts are with W9USI CJS.

A card from W9PK says that the item on page 58 of May Radio must refer to W9PKD. PK is on too, using 300 watts into T55's and a W9ZHB beam 32 feet high. The receiver is an HF10. In the month following April 16 he had 101 contacts with 32 stations in four districts and six states. He worked W6ANN and heard W7IFL.

W9YKX says things are picking up. W9ZRP in Omaha and OLY in Des Moines are active. YDC is on in Omaha too. CCY in Council Bluffs is R9 on a horizontal beam.

Now that W9VWU in Topeka has a three element horizontal beam, he is able to work W9ZJB in Kansas City, extending the relay that far. When someone takes VHG's place near Chicago, the relay should be able to do some big things.

112 Megacycle Notes

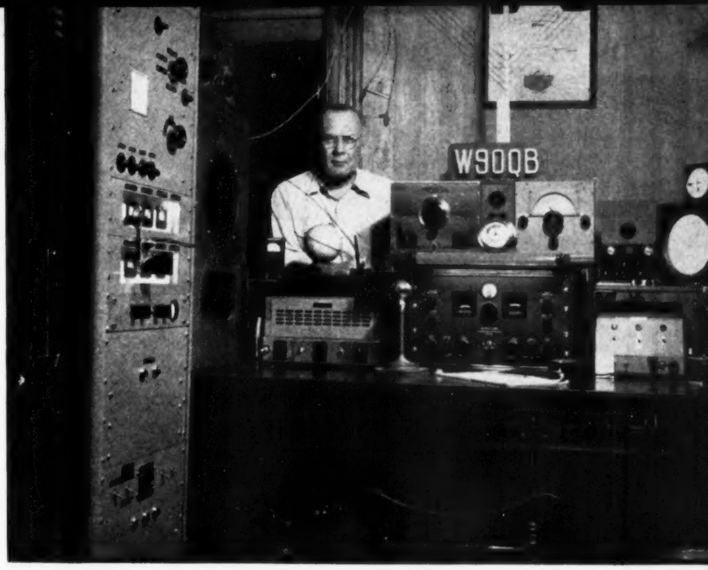
Twelve miles north of Ft. Monmouth, New Jersey, W9AOB found a hilltop for his 2½ meter rig. He has a revised *Smith* transceiver using an HY75, but uses a coaxial line externally quenched receiver.

Broderson, W6CLV, has some company on 112 megacycles in the form of W6LUM. W6QUY and LZO (or LZL) also in Salinas, are now getting interested. Twenty miles away in Watsonville, W9SHT SHQ have rigs about ready to go. Seven months of missionary work have done some good. CLV says that the East Bay gang includes W6SPA IIN YU SMF ACF OMC LCK CVP OJU SYO GXV MGR on 112 megacycles. W6ANL from San Carlos drove through Salinas to give CLV his first local QSO. In a contact with W6TZF in San

[*Continued on Page 75*]

W9OQB

W9OQB, Decatur, Illinois, is operated by C. C. Price, a safety engineer. The transmitter ends up in an 813 which runs at 350 watts input on c.w. and about 225 watts on phone. The rig is pre-tuned with bandswitching throughout. A 6SK7 is used as crystal oscillator and an 807 acts as driver for the 813. The final is plate modulated on phone by a pair of TZ-40's. There is quite an assortment of antennas including a 265-foot long-wire and a Siamese 10 and 20 rotary. The receiver is a Comet Super-Pro, and a Meissner Signal Shifter takes care of moving the transmitter about the bands.

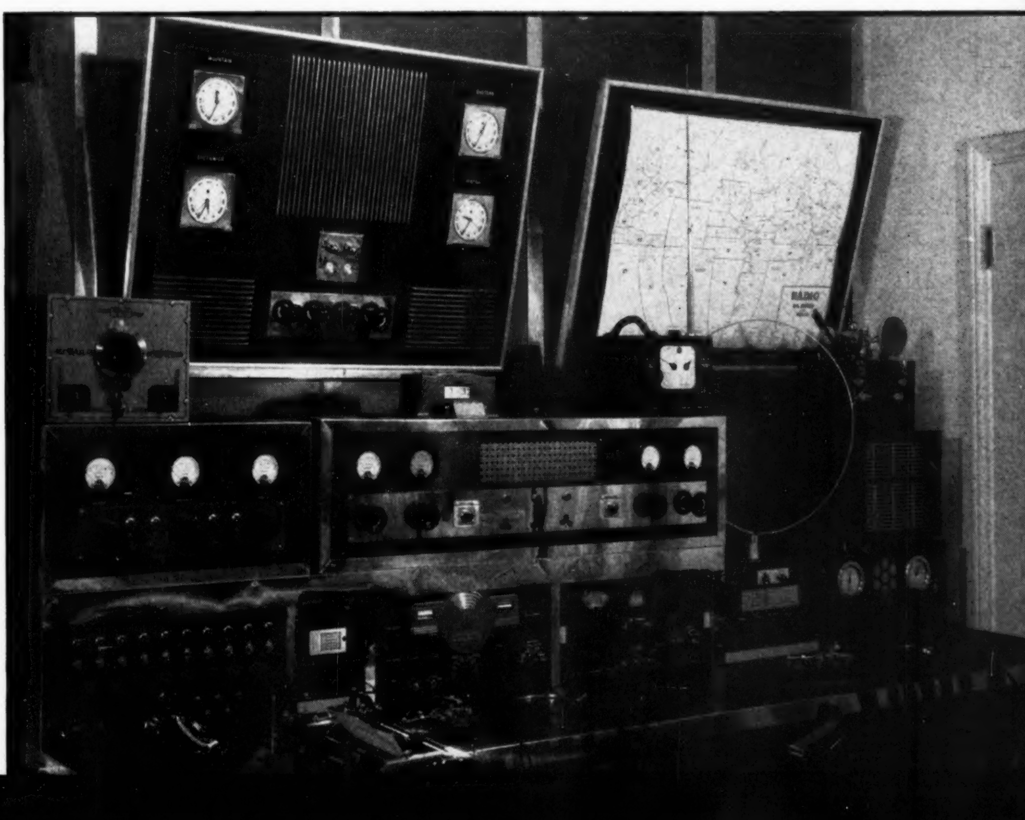


AMATEUR STATIONS

W6TOM

Jerry Joyce, better known to the fellows on 40 and 80 c.w. as Tom of W6TOM, is the owner of the rather elaborate layout shown below. The transmitter consists of two main r.f units: the 100-watt exciter and a 500-watt power amplifier which can be added at will. The exciter consists of a 6L6 crystal oscillator (which can also be driven by a Signal Shifter), a 6L6 doubler, and an 811 final. This unit, which can be seen to the left in the photo, was used as the transmitter until the power amplifier was built. The 500-watt final uses a pair of HK-54's with 1800 volts on their plates. It can be seen to the right of the exciter.

The station boasts four receivers: a Hallicrafters SX-23 is used for traffic work, a Sky Champion as monitor and standby, and a Sky Traveler portable and Sargent long wave for reception outside the station's usual routine. Jerry is a conductor and violinist with NBC in Hollywood. He has been on many hit shows in the past and is at the moment working on the Kraft summer show with John Scott Trotter.



W5IRO

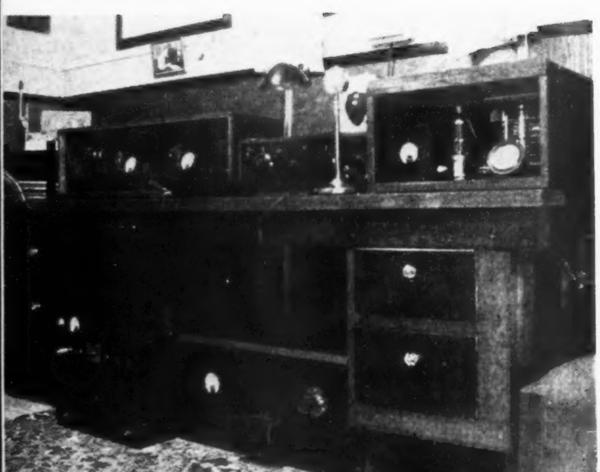
This photo shows the station of Charles L. Kelly, W5IRO, Hodge, Louisiana. The station has two 1-kw. transmitters. The 10-meter transmitter uses a Signal Shifter followed by a T-21, a TZ-40, push-pull TZ-40's and push-pull TW-150's. In the 160-meter transmitter the same Signal Shifter is followed by a TX-40, push-pull TZ-40's, and push-pull T-200's. The speech and modulator section, which is common to both transmitters, starts with a dynamic microphone followed by a Thordarson speech amplifier and a pair of HV-27's as modulators.

Two receivers are used. One is an HRO in the "rumpus room" shack, and the other is an NC-200 at the remote control position in the den of the house. Needless to say, the transmitters can be controlled from either position. The antennas consist of a three-element rotatable array for 10 meters and a single-wire fed antenna for 160 meters.

In addition to the two high-power rigs, there are several emergency and portable transmitters, complete with Vibrapaks for 6-volt operation. Emergency a.c. power is available from either a 2-kw. or a 300-watt engine-driven generator.

W5HLG

W5HLG, Amarillo, Texas—Operator, Wallace Wall. The transmitter uses a 6A6 oscillator-buffer, 807 final amplifier 6N7 speech amplifier, and 6N7 class-B modulator. The complete transmitter, including power supply, is contained in the cabinet rack seen at the right of the desk. Although the input to the final amplifier is only 30 watts, over 1000 contacts were made on 10-meter phone between September and December of last year. Most of W5HLG's operation is done on 10-meter 'phone and 40- and 20-meter c.w., but the transmitter is capable of working on all bands from 5 to 160 meters. During the ice storm of last November the transmitter was used by the Amarillo police department, and there provided communication continuously for three days. Power for the transmitter was supplied by an a.c. engine-driven generator. The receiver, which is at the left of the operating desk, is an SX16. For 10-meter work the antenna is a 3-element rotatable array.



W9DIB

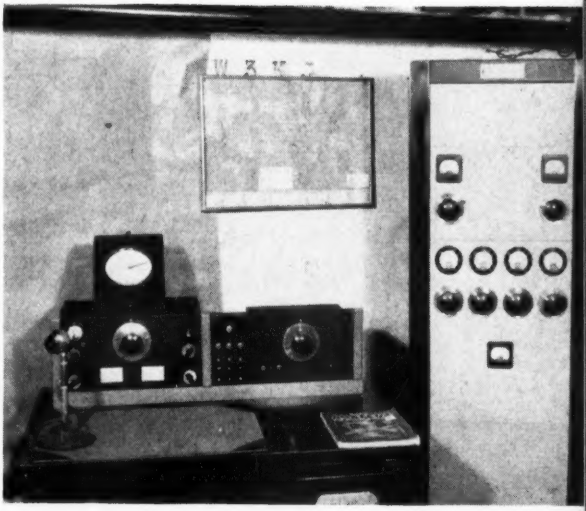
This photograph shows W9DIB, Mitchellville, Iowa, which is operated by Thomas S. Wildman. Both 'phone and c.w. are used, the normal bands of operation being on 10, 20, 40 and 75 meters. The input on c.w. to the V70D amplifier stage is 300 watts, while the phone input is 150 watts.

W9RIL

W9RIL, St. Cloud, Minnesota—Operator, Beryl Millett. The relay rack at the right houses the exciter unit consisting of a 6A6 oscillator-doubler stage and an 807. Later, the speech amplifier and measuring equipment seen on the desk will be installed in this rack. The rack on the back of the desk contains the speech amplifier, final amplifier, class-B modulator, and power supplies. The input to the final amplifier is 500 watts. Activity at the present time is confined to the 20-meter 'phone band, where a 4-element rotary beam one-half wave above ground is used for an antenna. It was found that a ground screen consisting of 16 half-wave radials below the antenna considerably improved signal reports. The 6-foot gasoline-powered model airplane seen hanging from the ceiling is in the process of being adapted for radio control.

●

W3KJ



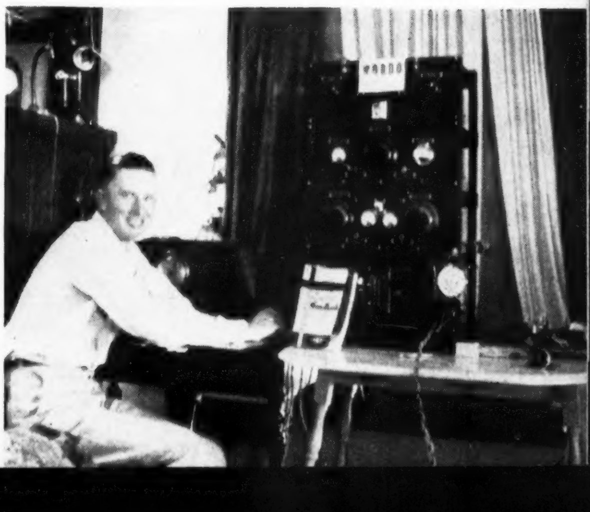
W3KJ, Springfield, Media, Pennsylvania—Operator, Frank J. Kern. This 150-watt station is located in a basement radio shack. The transmitter proper is contained in the enclosed rack at the right of the operating desk. Starting at the bottom, the rack contains the following units: 1750 or 1500-volt power supply for the final amplifier, two 750-volt supplies for the modulator and buffer-doubler stages, the modulator using a pair of 809's, buffer-doubler unit with an 807 and an 809, and the final amplifier using an 808. Above the final amplifier deck is a spare panel which will contain the modulation indicating equipment.

On the operating desk may be seen the crystal microphone, HRO receiver, rotatable antenna direction indicator, control panel, and the v.f.o. using a 6J7 and 6V6. Switches on the control panel are arranged so that any stage in the transmitter, the speech amplifier, the v.f.o., or the receiver may be turned off or on individually.

●

W9BDO

W9BDO, Seneca, Nebraska, is operated by Bud Crawford on all bands, phone and c.w. Although this picture was taken some time ago the transmitter remains much as shown. The only change of importance has been to replace the push-pull 210's in the final amplifier with a single 812. Operation is mostly on 75-meter phone and 40- and 20-meter c.w. Separate single-wire-fed or twisted-wire-fed doublet antennas are used on each band on which the transmitter is ordinarily operated. The transmitter is crystal controlled on all bands, an old style e.c.o. having been taken out and replaced by a crystal oscillator shortly before the present trend to v.f.o.'s began. Crawford prides himself in his speed of speech, having once been reported by an NBC pickup engineer as second only to the late Floyd Gibbons in talking speed.



With the Experimenter

REDUCTION OF DRIFT IN V.F.O.'s

By R. K. DIXON,* W8DYY

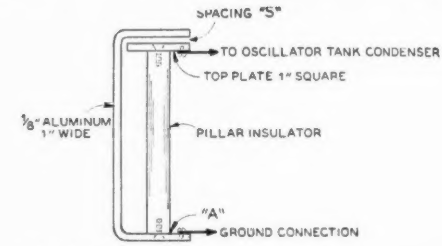
Most self-excited oscillators are afflicted with frequency drift caused by the reaction of changes in temperature on the values of circuit components. As a rule this drift is inversely proportional to the change in temperature; an increase in temperature lowers the frequency, and vice versa. Although care in construction and choice of materials will quite often reduce this form of drift to a small amount, it is almost impossible to eliminate this type of drift completely without some sort of electrical compensation.

Condensers with a negative temperature coefficient for drift compensation have been placed on the market by several manufacturers. These condensers are made in several capacity ranges and with various coefficients of change. However, their main disadvantage is that they are made similar to fixed mica condensers and hence their capacity values and coefficients are fixed at manufacture. Hence it is necessary beforehand to have some definite knowledge of the rate of drift, temperature rise, and circuit values of the oscillator before the particular condensers needed to correct a particular oscillator may be ordered.

A condenser with a negative coefficient can easily be constructed so that a varying amount of compensation can be obtained. As shown in the accompanying drawing, all that is required is a pillar standoff insulator and some pieces of aluminum.

The operation of the compensating condenser is easily explained. The isolantite insulator has a much lower expansion coefficient than the aluminum, and as a result the spacing between the plates will increase with an increase in temperature due to the expansion of the aluminum.

The condenser may be made with the dimensions shown and with the spacing "S" made small as possible. The condenser should be mounted in the immediate vicinity of the oscillator tank circuit. It should be connected directly in parallel with the oscillator tank condenser, which is then adjusted to compensate for the additional capacity. The oscillator should be tested for drift and if it is found that it has been over-compensated, the spacing S should be increased, the tank retuned and the oscillator again tested for drift. It



Line drawing of the homemade compensating condenser. The isolantite pillar insulator may be of either the 2½-inch or 4-inch size; the greater length will give a larger possible amount of compensation. Washers may be added at "A" between the insulator and the aluminum to decrease the spacing at "S". Fine adjustment may be made by bending the aluminum away from the top plate. It is not necessary that the two plates be absolutely in line.

should be possible to establish a balance in most oscillators with the dimensions shown. However, if more compensation is necessary the size of the aluminum plates forming the condenser can be increased or the length of the insulator increased.

It may be found advantageous to shield the oscillator coil with an aluminum shield approximately the same thickness as the compensating condenser so that the temperature rise of these two units will be equal.

In one particular case, an oscillator with approximately twenty kilocycles drift per hour on twenty meters, was entirely corrected with a condenser constructed as shown in the sketch.

A word of precaution might be in order. The aluminum should be of heavy gauge or well braced to prevent excessive frequency wobble with vibration.

STABILIZATION OF GRID BIAS

By JOHN E. SHAW,* W1IN

It is common knowledge that tubes such as the 6L6 or 6F6 in amplifier or modulator service deliver considerably more power output when operating with fixed grid bias as compared with self bias. This power reduction with self bias is due in part to an increase in

*RD 4, Box 393B, Johnstown, Penna.

*220 Tremont St., Melrose, Mass.

bias voltage across the cathode resistance on peaks of plate current. This increase in bias tends to limit these current peaks and therefore, the output of the system. If this drop across the cathode resistance can be held more nearly constant, the conditions of fixed bias can be approached. If this resistor is forced to carry constant bleeder currents in addition to plate current, fluctuations in plate current will have a proportionately lesser effect on the bias voltage developed. The circuit is indicated in figure 1.

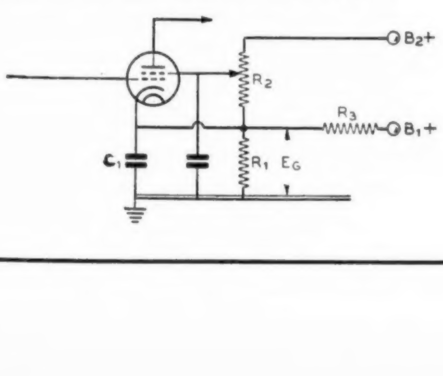
The bleeder current of the speech amplifier power supply might be added (B_1 +) as well as that of the screen voltage divider and even the cathode currents of previous class A stages. Place as much constant current through R_1 as possible so that plate current is only a small part of the total current. R_1 must be such that E_G is the proper value for this increased current through R_1 and must have a higher power rating. In most cases it is possible to pass an additional constant current through R_1 as large as the plate current itself. Bias voltage fluctuation will then be less than 50% of the original value and a considerable increase in output will be noted.

Due to power supply regulation plate current peaks will cause plate voltage dips. These will produce a decrease in bleeder current which tends partially to cancel the effect of increased plate current through R_1. This results in further stabilization of voltage across R_1. This circuit has functioned well both with single-ended and push-pull output tubes. It could be applied to class AB_1 triodes also successfully.

C_1 is the usual by-pass condenser for audio frequencies. It could be somewhat larger than normal, especially when good low frequency response is desired.

Figure 1. The stabilized grid bias circuit.

C_1—Larger-than-normal cathode by-pass condenser
R_1—Cathode bias resistor of reduced resistance
R_2—Bleeder on amplifier supply with screen tap
R_3—Possible additional bleeder on other supply



A SIMPLE 400-CYCLE AUDIO OSCILLATOR

By WORCESTER BOWEN,* W6LFF

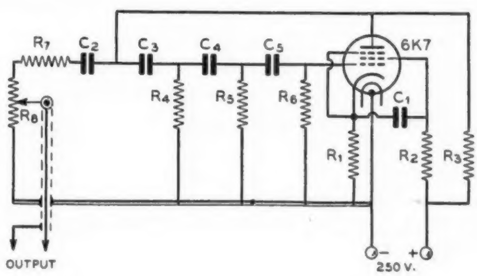
A sine-wave audio oscillator can be put to a number of worthwhile uses around the amateur station. Chief among these uses is in conjunction with an oscilloscope, as a means of checking radiophone transmitters. The accompanying diagram shows a 400-cycle resistance-capacitance-tuned oscillator based on recent developments in simplified phase-shift oscillators[1].

Despite the simplicity and economy of construction evidenced by the circuit diagram, the waveform and frequency stability is superior to most low and medium priced instruments. The oscillator should be built in a metal box and the output leads shielded to avoid hum pickup. Other than this shielding no special precautions need be observed in building or using the unit. Filament and plate power may be "borrowed" from a receiver, the speech amplifier, or another source. Or a small power supply can be built in if desired, making the oscillator a complete, self-contained instrument. Another possible arrangement would be to build the oscillator directly into the speech amplifier, with a switch to turn the unit on when making modulation checks or to turn it off when normal operation is taking place.

*407 N. Golden West, Temple City, California.

[1]Ginzton and Hollingsworth, "Phase-Shift Oscillators," *Proceedings* I.R.E., February, 1941, p. 43.

[*Continued on Page* 76]



Wiring diagram of the simple 400-cycle audio oscillator

C_1—0.1-μfd. 600-volt tubular
C_2—0.02-μfd. 600-volt tubular
C_3, C_4, C_5—.0001-μfd. mica
R_1—200 ohms, 1 watt
R_2—400,000 ohms, 1 watt
R_3—50,000 ohms, 1 watt
R_4, R_5, R_6, R_7—1.5 megohms, ½ watt
R_8—500,000-ohm potentiometer

YARN *of the* MONTH

HAM'S WIFE

Required Reading for all "Radio Widows"

"The snow is melting," my husband smiled. "The old weatherman knows that you and I are having a honeymoon."

"Second honeymoons are risky," I countered.

"How's that?"

"Oh, I don't know. . . ." And I didn't know then. I kept thinking: *I have two sons—he has one. Will they get along?*

I couldn't see the card, *W4CRA,* that he carried in his pocket. Not once on that honeymoon did I remember his ever having said to me, "Amateur radio is my hobby!"

The third evening after we settled in Atlanta, my husband smiled politely and asked, "Where do you think we should keep it?"

"It—?"

"The radio equipment."

"Oh," I felt relieved. "Why, just anywhere, honey. Most people keep their radios in the living room."

I can still see the peculiar expression on his face as he answered, "No, I don't think you would want it in the living room."

"Well, the dining room's large—too large for us. Why not put it in there next to the windows?"

"Did you ever see an amateur rig?"

"No," I bubbled back. "But I can hardly wait to see yours."

"You see," he went on, "you have to have an outlet for your antennas, and plenty of wall space for the cabinets."

Antennas? Wall space?

"The bedroom would really be the logical place—that is—unless I used the basement. Let's take a look," he suggested.

And I was the one who decided upon the bedroom!

But even then I was not prepared for the events of the next day. Paul, my eight year old, came panting into the living room, "Mama," he squealed, "there's a big Army truck in the yard, and some men are bringing in—*something!*"

I hurried to look. Twelve men, whose every footstep seemed measured with tenderness and respect, were tremulously approaching with a ceiling-high cabinet. Through my living room door and into the bedroom they passed without a word. Tiptoeing to the back door, I crept down the steps and around to the side of the house. Three men were fastening a piece of tall green framework to my chimney. Two others, across the street in a vacant lot, were fastening another wire to a new pole, which someone must have erected the night before.

By now I was a little dazed. I knew that as an Army signal officer, my husband's work was concerned with radio communication. But as a job keeps a man away, I hadn't counted on any more radio in the home than Charlie McCarthy, Jack Benny, et al. But my sons were delighted.

When my husband came home that evening, I bravely smothered the impulse to complain. After all, I was a bride of less than two weeks.

"How do you like it, honey?" were his first words.

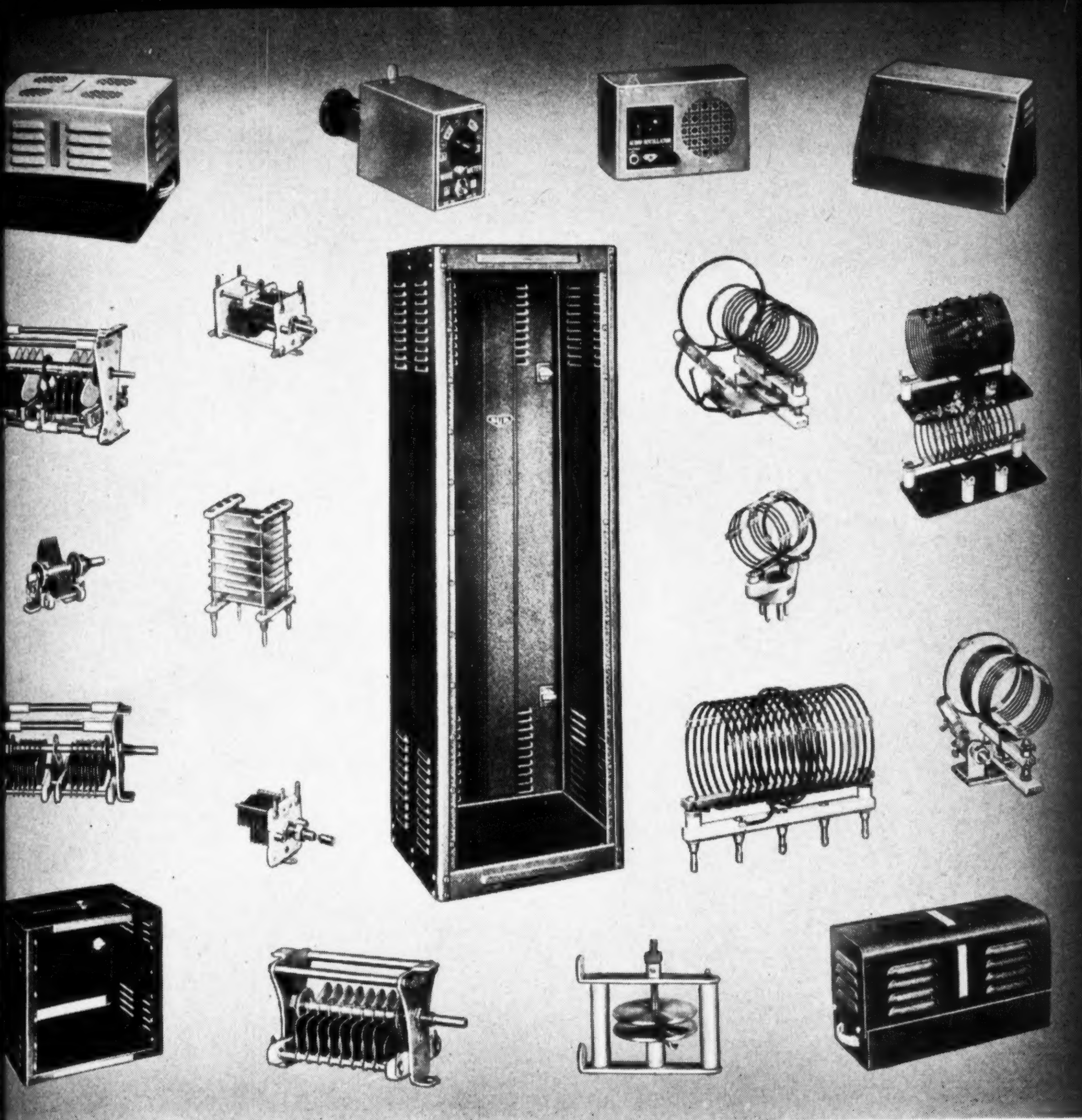
"Fine, fine," I answered, thinking he was speaking of the house. The furnishings were lovely and comfortable.

"Wait until you see how it works." His face glowed. "I had to get the rig set up before tonight, because I have the Army Amateur Net for the State at seven o'clock."

"I see," I said and hurried back to my potatoes.

Breathlessly, I set my meal on the table. Second marriage, or not, every biscuit and every spot of gravy was a precious event in my life. A hissing noise suddenly sounded from the bedroom. Sadly and without forewarning,

By LOU MYRTIS VINING (xyl of W4CRA)



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the coffee percolator gave a gurgle and quietly died. Dinner and I were both in the dark.

"Just a minute," my husband called cheerily, "I blew a fuse."

"Well, dinner is ready." I could feel the rising note of impatience in my voice.

After the dinner dishes, I hurried into the living room. The boys were building an elephant train. "And the Army is marching through the bedroom," I thought. But I went into the bedroom and took my seat.

My husband was talking quietly into a cloth-covered mike. *W4 . . . calling the Georgia Army Net.* Call letter after call letter was repeated as various operators from over the State reported in to stay or to say they were just going out! But whether the hams were coming in or going out, my husband kept right on announcing call letters for the next two hours.

Finally we went to bed.

"Honey, how did you ever happen to get interested in ham radio?" I asked.

"Well," his eyes glowed, "I first began studying for a class C license—"

I was getting sleepier and sleepier, but I could tell that this explanation was destined for far—into—the—night. "Excuse me a moment," I interrupted, as I slipped into the bathroom and bathed my eyes with cold water. Maybe this would help to keep me awake. It would never do to go to sleep.

"Later on," he continued, "my enthusiasm led me to take the Federal Communications examination for a class A license—"

". . . Amateur radio is also ideally suited for a woman's hobby—"

Drowsily my thoughts spread around. Did he really mean that he wouldn't mind if this special amateur air was all cluttered up with talk of Tommy's tonsils—or the pompadour mistake? Did he?

After my husband left for work the next morning, I took time to do some serious thinking. I loved my husband and his life was built around that radio rig. I could choose one of two courses: I could knit gently and ignore it; or, by listening to him talk every day and reading what I could find, I might become interested in amateur radio.

I hurried into the bedroom. Strange steel-toned tacks and presumptuous panels were more than holding their own. Gingerly I picked up a booklet entitled, "How to Become a Radio Amateur." My eyes stopped on a sentence:

More often an inexpensive outfit assembled at home in spare moments . . . becomes a modern Aladdin's Lamp!

Aladdin's Lamp—ugh! Twenty divisional conventions, I read, and several hundred "ham fests" are held yearly. Ham fest. . . . Conjuring the word, I must have realized that I would have just cause to remember it later.

When my husband returned at evening fall, I sparkled before he had a chance to speak, "I've been reading about ham radio."

Not even the moon of a month ago had put such a look into his eyes!

The telephone rang next day to let me know that my college roommate was also living in Atlanta. Would I please come and bring my family to dinner on Tuesday evening?

I was elated. I had left my family and friends in Texas—what would Maybelle think of the children? My brand new husband? I hadn't met her husband either.

"My college roommate called," I greeted my husband at the door that afternoon. "She wants us for dinner tomorrow evening."

His brow clouded. "Honey, I'd like to—I really would—but the Southeastern Emergency Net meets at eight o'clock on Tuesday evening, and there might be some traffic for Atlanta."

"Traffic—traffic—" The word made a strange sound in my ear, as the room began to take on a slightly purplish cast.

"Very well," I managed to answer. "I'll tell her that we will come on Wednesday."

My husband was gradually moving all of his radio rig home from the army post. I stood at the kitchen window one day and watched a ninety-foot mast take its place beside my double petunias in the back yard. The same day a huge steel tower was carefully placed along by the dahlias at the side of the house.

"The steel tower's for the twenty meter band," my husband explained that evening. "We can talk to Texas on that band."

"And that mast at the back?"

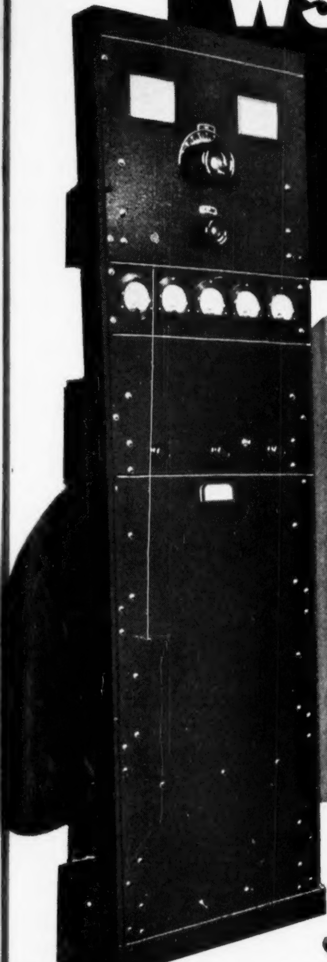
"Oh, that's just a taller 75 meter antenna pole. It does look nice, doesn't it?"

As the days passed, I learned better how to pattern my life. I could always expect my husband to radio before dinner, until nine or ten in the evening, and sometimes before going to work in the morning. I could expect telephone calls during meals where such unsatisfactory phrases as "harmonic radiation" or "capacity coupling" cooled the coffee or melted the desserts. I could expect to prepare dinner one or two evenings a week for ham friends from over the State, and I could expect kind, courteous, and gentle treatment for the children and myself at all times from my particular radio ham.

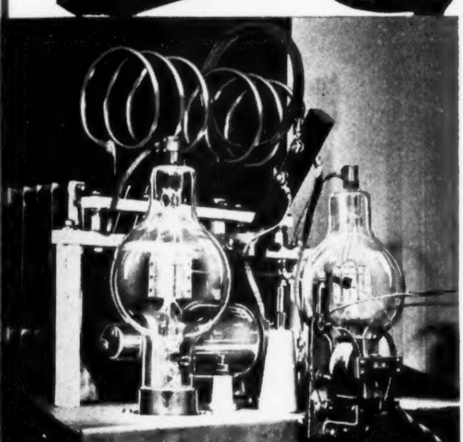
But the courteous treatment didn't keep me from being discouraged. Katherine Cornell had come to town on Army Radio Net night, and Robert Frost emerged on the hour with the Southeastern Emergency Net. Could a marriage be built, I wondered, from this maze of high antenna poles?

W5CXH 1939 winner Hiram P. Maxim Award as most outstanding radio amateur

...another Eimac user



The transmitter shown has just been placed on the air by W6OGZ *and* W5CXH *operating it jointly. The final amplifier consists of a pair of Eimac* 100TH's *and an Eimac Vacuum Tank Condenser in the tank circuit.*



"...the 100TH's *in my rig work as well on* 5 *meters as they do on* 160*"...says Dawkins Espy* W5CXH

The list of achievements by W5CXH is long enough to fill this page. Reference to the August, 1940 issue of QST will give you a fair idea of his ability. The point here is that intelligent use of high quality equipment almost inevitably brings outstanding results. The choice of Eimac tubes and VC condensers by W5CXH is corroborating evidence of the oft' repeated statement that "Eimac tubes are first choice among the leading radio amateurs." Selecting equipment of this calibre is surely the first step you can make toward outstanding achievements in radio.

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"Honey," I began one hot July evening, "I would like to talk to you about our lives." Tremulously, and feeling sorrier for him than for myself, I began.

"We have three boys (as one of them was his, I thought it wise to mention the children first) and I don't believe we give them enough of our time." I was beginning to stammer. "I—I—think you spend entirely too much time with the radio!"

No sooner was it said than my conscience smote me. Could it be possible that I was jealous of steel racks, and black cabinets

"I've been selfish," he granted. "But I thought you liked the radio, too."

I could not bear the stricken look on his face. "Oh, I do—I do—I was just thinking about the children—"

The saddened look in his eyes haunted me all next day. For several weeks I bubbled enthusiastically about the rig—insisted that I be allowed to learn more about harmonics and high transmission lines. When a box of cracklins came in for my husband, I didn't have to be persuaded to say "hello" to Mary, a ham girl friend over the air. She, not being married, was a y.l. (young lady) while I, a ham's wife, was an ex-y.l.

With my husband I visited a Federal Communications Commission monitoring station at Marietta, Georgia, where I learned that all radio stations, professional and amateur, are carefully monitored. On many cold clear evenings I heard my husband talk to the Byrd expedition at the South Pole. And one Sunday morning I heard him give the first news to the outside world that on account of a tropical storm, Savannah, Georgia, was without all communication but short-wave radio.

One evening when suitcases were all packed for a vacation trip to Texas, a shrill ring called us to the telephone. Army orders requesting that my husband report at once to an Air Base in Florida were on the wires.

Disappointed at not going to Texas, I could read the joy in my husband's face. He was born in Florida—his mother and dozens of radio friends still lived there. Realizing suddenly that orders meant moving everything, I turned quickly to my husband. "How will you ever move the radio equipment?"

"I'll ship the transmitters, and carry the antenna poles in the trailer."

"The trailer? But some of the poles are ninety feet long."

"I'll disassemble those."

Amid sad goodbyes to the neighbors and a last tearful look at my dahlias, we finally started to Florida. Having taken one look at the load on the pint-sized trailer, I knew our trip was doomed. Steel partitions, green rafters, bolts, cross pieces and screws were piled to the top, while parts of a disassembled ninety-foot mast protruded from the rear end.

At the first corner there was an awful lurch, as the car started swaying from side to side. "Don't look back, Mama!" the boys warned, "Don't look back—Gee, but we're rocking!"

No matter how we drove it was the same. See-Saw, Marjorie Daw, we slid from one side of the road to the other for almost six hundred miles. Speed, hill, valley, or dale made no difference to those high antenna masts. Disassembled or not, they knew as well as I that they were never meant to ride in a trailer. My husband and I stopped speaking after the first hundred miles. Living at home with a whole amateur rig was bad enough, but travelling with the parts of one was infinitely worse.

But at last we are at home in Florida. Planks and pulleys are rapidly being accumulated in the side lot next to the yard. I'm to call at 12:15 today to remind my husband to bring some guy wire, and by the weekend I am sure that he will be on the air. He will be a portable four until the F.C.C. modifies our license to the change of address.

Last Sunday I went to my first hamfest, at Sanlando Springs. Being a bride of less than a year, I expected my husband to spend the day looking prideful about what he had rediscovered in Texas. But, unfortunately for me, I didn't know my hamfests.

"Lou, this is Mrs. Cole," my husband said upon arrival. And it was Mrs. Cole, an Orlando ham's wife, who introduced me where I was introduced at all. My husband and the other hams, you see, had to begin the important business of incorporating a spot that's to be known as "Ham Haven"!!

"It's to be a glorified spot," the announcer told us in the afternoon. "Ten acres of Florida's best land have been contributed. Hams from all over the world can meet at Ham Haven to display their equipment and talk about their rigs!"

But no amount of ham enthusiasm could ease the pain in my heart. Here I was in Florida, my husband's native state, at my first hamfest and my husband was totally unmindful of my existence. Tears blinded my eyes.

Then I was introduced to Doc's wife, Doc being the nightly end of more than one hour-long schedule. "Does it ever get any better?" I asked gently.

"You mean the radio?"

"Yes."

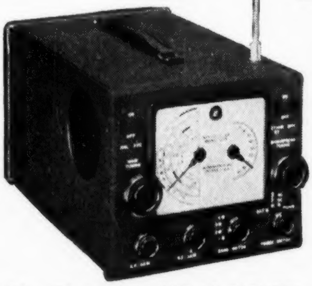
"No—never. I've been living with it close on to twenty years. You must learn to talk. Why, I have a transmitter in practically every room."

[*Continued on Page 72*]

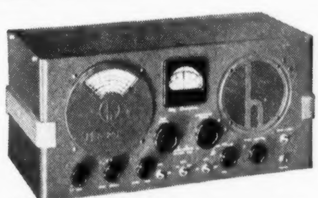
BUY HALLICRAFTERS ON BOB HENRY'S (W9ARA)

Easy Terms!

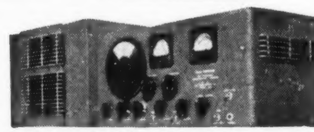
You always get satisfaction in a purchase from me. . . . I personally guarantee you can't buy for less or on better terms elsewhere. You can't beat my friendly credit plan. Write and tell me what you want—I sell all makes and models of receivers and amateurs parts—remember we can always arrange the terms. **BOB HENRY (W9ARA)**



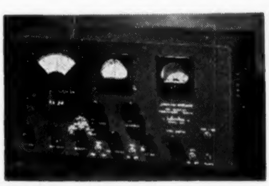
The Sky Traveler (Model S-29). A universal receiver, you can take it with you anywhere. Operates on 110 volt AC-DC or from self-contained batteries. 9 tubes. Covers from 542 kc. to 30.5 mc. (553 to 9.85 meters) on 4 bands. Self-contained extension type antenna. Wt. including batteries 18 lbs. **$59.50**



The 1941 Sky Champion (Model S-20R.) Represents one of the best values in the communications field. 9 tubes; 4 bands; covers 545 kc. to 44 mc.; separate electrical bandspread; inertia bandspread tuning; battery-vibrapack DC operation socket **$49.50**

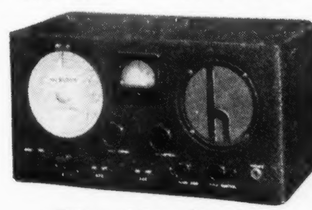


Model SX-25. Incorporates every worth-while advancement that has been made in the communications field. 12 tubes, covers from 540 kc. to 42 mc. in 4 bands. Separate calibrated bandspread dial for the 10/20/-40/80 meter amateur bands. 10" heavy duty PM dynamic speaker in matching metal cabinet. Complete with speaker crystal and tubes **$99.50**



Model SX-24. A great communications receiver value. 9 tubes; 4 bands; frequency range of from 540 kc. to 43.5 mc.; one stage of preselection; single-signal crystal filter standard equipment; DC operation socket-battery or vibrapack **$69.50**

New 1941 Super Skyrider Model SX-28. Sets a new high in quality performance. 15 tubes; two stages preselection; 80/40/-20/10 meter amateur bands calibrated; 6 step wide range variable selectivity; calibrated bandspread inertia controlled; frequency coverage 550 kc. to 42 mc. With crystal and tubes **$159.50**



The Sky Buddy (Model S-19R). Designed to produce superior performance at a moderate price. 6 tubes; 4 bands; continuous coverage 44 mc. to 545 kc.; electrical bandspread; built-in line filter **$29.50**

HENRY RADIO SHOP ✦ BUTLER, MISSOURI

The Amateur Newcomer

BANANA BOAT ON LAKE ERIE

By LEONARD J. SADOSKI,* W3HRF

Everybody just now is Code Conscious! At least, everybody in whom we amateurs could possibly be interested is code conscious. The rest of the world just doesn't count. It used to be jazz, then jig-saw puzzles, recently swing, and now code.

People are buying code oscillators for week-end parties. There are, I believe, pencils available imprinted with the code for the amateur who is likely to forget it under the stress of 50 w.p.m., and there are scads of other things, generally speaking, with which people are being informed of the existence of code. None of 'em, though, will help the amateur in the following problems. For example:

Almost every book I read which dealt with the ways and means of the code admonishes the sender to spew perfect, machine sounding stuff for the edification and impression of the feller at the other end. You must not, under any circumstances, go over ten unless the other feller insists half a dozen times and threatens you with eternal damnation if you don't. It is more blessed to send at a speed of fifteen words a minute when chatting, than to send faster so that the conversation is more "easy."

But suppose the feller you're gabbing with didn't read all those fine books on perfect sending—then what? I mean, what besides goosepimples?

Here you are a machine-made op. Can copy perfect stuff at fifty. So what! How many people send perfect stuff? Even I (ahem!) don't.

The other feller often breaks all the rules of "The Perfect Operators' Telegraphing Manual and Handbook." He chops the words up. He mangles 'em. He draws the letters apart and puts that *?§%* swing on the remaining hodge-podge. He breaks and repeats without any warning.

And Our Percy at this end, yea, the same who won a goldplated bug for sending the most perfect code at the last convention, is in a dither. He breaks into a rash, a sweat, and an uncontrollable itch in the small of his back. For Dear Percy can copy mechanical stuff perfectly, but when the code is humanized, he is stuck.

I don't mean that it should be considered fashionable to send lousy code, that people who own bugs should take off the weights so that they may always send too many dots. Dear me! The pathos of it!

What I am trying to drive home is this: Before you can consider yourself a good operator, you have to be able to take any kind of mush under any circumstances. You ought to expect the feller at the other end to break every rule ever made for good sending! Then, expecting and ready for the worst, you won't ever be embarrassed.

In the Morse business (which, believe it or not, is more closely associated with radio than you think), receiving is much harder than sending. We don't have static, of course, but the wires are as temperamental as a movie actress who has made good. If the relay, especially on long lines, is not very carefully adjusted, you will be unable to break the other feller. In Morse, of course, there is a switch attached to the key for the purpose of opening the circuit. It is most disconcerting when one opens the circuit, and then closes it again, to find the op. at the other end going like sixty as if nothing had happened.

Naturally, if the relay is just a little out of whack, the dots won't come through clearly, or will just come through clearly enough to make you suspect that they *are* dots and not flickers.

Then, there is Forgetful Phil. Phil is the feller who sends a batch of messages and then

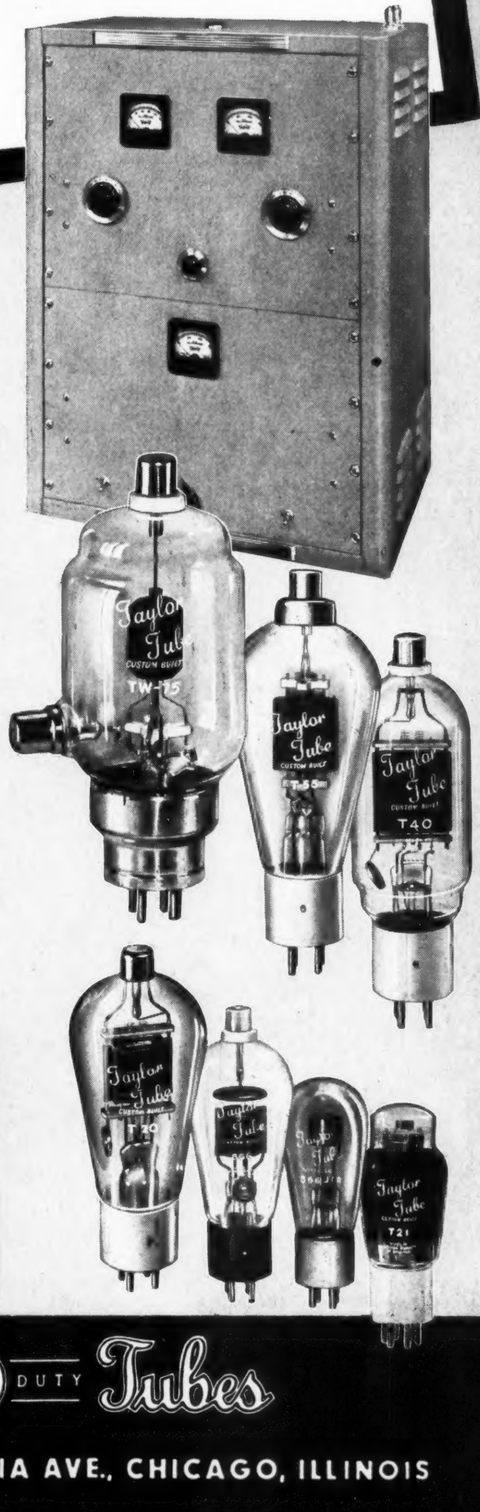
[*Continued on page 91*]

*1627 E. Berks St., Philadelphia, Pa.

Now is the Time—

For Every Amateur to Put His Rig in Tip-Top Shape with

Taylor Tubes



EACH TUBE IS CUSTOM BUILT
TO GIVE "MORE WATTS PER DOLLAR"

During all emergencies, the amateur has proved himself ready and able to do his part. Now, as never before, he is being offered an opportunity to prove himself and amateur radio an asset to his country. The ARRL Proficiency Awards are helping hams improve their copying and operating ability. Ham shacks all over the country are bustling with activity as rigs and associated equipment are being over-hauled and put in A1 operating shape. And it's here that knowing hams are turning to TAYLOR TUBES for their greatly increased safety factor, longer dependable life, lower operating cost and better all round performance.

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TAYLOR TUBES, INC., 2341 WABANSIA AVE., CHICAGO, ILLINOIS

A Cathode Ray Indicator For the Rotary Beam

[*Continued from Page 32*]

the compass and intermediate markings at 30° intervals are laid out about the screen of the c.r. tube.

Power for the indicator is controlled by the same switch that turns on the exciter and speech amplifier. The changeover switch is directly below the tube screen, and immediately to the left are the focusing control for oscilloscope operation, and the switch for controlling the beam antenna. Thus, all controls necessary for control of the beam antenna and indicator are conveniently grouped.

The T902 tube is magnetically shielded in accordance with common practice and is rigidly mounted at the rear, provision being made for orienting the tube. A thin layer of rubber tape (splicing compound) cemented around the opening in the panel serves to prevent a metal to glass contact around the tube screen. This is advisable since the envelope of a c.r. tube is easily damaged.

The primary requirement for the remote assembly is that means be provided for driving the switch directly from the rotating member of the beam support. A weatherproof housing for this unit is also imperative, and it is further desirable that the expansion controls be accessible after installation. Access to them would be necessary only in the event of tube failure, but the controls are as easily mounted with their shafts protruding through the floor of the housing as anywhere. Once set, they may be forgotten.

The inter-connecting cable should be of the rubber-covered, multi-conductor type, or should be made up with five rubber-covered conductors. The only requirement is that it be weatherproof. Cable connections are soldered permanently at the remote assembly, and terminated with an octal cable-plug at the indicator. A socket is provided for this connector-plug at the rear of the indicator chassis.

Adjustment

It is desirable that the entire indicator, including the remote assembly, be completely adjusted before installation. For this it is unnecessary that the full length of cable be included in the circuit since the over-all resistance of the remote assembly is sufficient that the few ohms resistance introduced by a cable can be ignored entirely. A general procedure similar to that outlined below is advisable.

Note: BE SURE THAT THE INDICATOR POWER SUPPLY IS TURNED OFF EACH TIME BEFORE ATTEMPTING TO MAKE ADJUSTMENTS OF THE TAPS ON R_1.

Connect the switch assembly to the indicator by means of a cable of any convenient length. Set the cathode tap "B" approximately ½ inch from the negative end of R_1, and tap "C" at a point which will place an estimated 100 volts on the focusing anode.

Set S_3 as it is shown in figure 1 (position 3), and turn the four expansion controls to the position where no voltage will be placed on the resistor networks.

Turn on the indicator power supply, and place S_2 in the BEAM position. The c.r. tube screen should fluoresce, and the focusing and cathode taps may then be adjusted alternately until a spot of reasonable low intensity and approximately ⅛ inch in diameter is obtained. Here, it should be pointed out that the screen of these tubes may be damaged by a high value of beam current on a sharply focused spot. Therefore, it is only reasonable that the beam intensity should be adjusted for the lowest value that will allow a satisfactory indication.

A rocking movement of the expansion control R_5 should now cause the fluorescent spot to move back and forth along a line from the middle to the edge of the tube screen, delineating the top half of the vertical axis. The tube should then be oriented so that the spot can be brought vertically to a position directly below "N" (North) on the panel.

S_3 should then be rotated slowly, and the expansion controls adjusted, one by one, until the spot moves in a symmetrical manner about the perimeter of the tube screen.

At this point it is quite probable that you will find the spot traveling counter-clockwise when the switch is rotated clockwise. This condition is rectified by reversing the leads to the ends of the horizontal network.

As a final step, it is likely that the taps "B" and "C" will have to be readjusted for the most desirable beam intensity and focus.

After these adjustments have been completed, the indicator is set up for oscilloscope operation merely by connecting in the desired sweep voltages at the proper terminals. With S_2 thrown for OSCILLOSCOPE operation, R_2 is adjusted for sharp focus in the conventional manner.

In checking modulation with the trapezoidal figure, it should be borne in mind that the electron beam will remain sharply focused on the screen if some means is not incorporated for turning off the beam current simultaneously with the transmitter. In this equipment, for that reason, one contact of the Send/Receive switch (not shown) is wired in place of the jumper designated as "Y" in Figure 1. This arrangement protects the tube in the event that S_2 is inadvertently left in the OSCILLOSCOPE

position when the transmitter is not operating.

Installation

Assuming that a means for driving the switch assembly from the rotary element of the beam structure has been provided, the indicator is ready for installation. Only one difficulty might be encountered. In some installations the operation of the indicator might be impaired by pick-up of r.f. in the inter-connecting cable. This difficulty is easily surmounted by installing isolating resistors of 20,000 to 50,000 ohms in series with the deflector leads at the indicator, and bypassing the r.f. with .01 μfd. condensers. The resistors will have no undesired effect upon the operation of the indicator, since the current flowing in the deflector lines is quite negligible.

Tube Operation

The only matter which might bear further comment is that of tube life. Actually, there is little danger of damaging the screen of one of these smaller tubes if the simplest precautions are observed. During the past year the writer has had occasion to use the 2-inch and 3-inch tubes under conditions that required the beam to be focused upon a single spot for as much as six or eight hours at a time. A dozen or more tubes were so used without damage to the screens. Although precautions were taken to keep the beam current sufficiently low to prevent damaging the tubes, the fluorescent spot intensity was such as to be visible at fifteen feet in subdued daylight with sufficient brilliance for satisfactory operation under any normal conditions.

Properly installed and adjusted, the chances are the c.r. indicator will go right on giving service for a long time to come. What is more, it does a good job of it. It is fast, too. It operates in the time it takes an electron to get from here to there, which is nothing casual. And it is an advantage, combining in this way a modulation monitor and a beam indicator; you have an instrument that not only tells you what the stuff looks like, but where it is going.

Intercommunication Circuits For Police Radio Systems

[*Continued from Page 35*]

When the switch is at position B, plate voltage is applied to the transmitter, the plate end of T_2 is connected through the relay to C_1, and any signal received on "ultra-high" is transmitted on the headquarters frequency. This is "feedback" operation. Under these conditions, all signals received on "ultra-high" are audible to the headquarters operator, but the headquarters microphone is inoperative.

If, during feedback operation, the "press to talk" button on the headquarters microphone is pressed, the relay operates, disconnecting the receiver from the transmitter, and making the headquarters microphone operative. As soon as the "press to talk" button is released, when the switch is in position B, feedback operation is automatically resumed.

Adjustment

It should be obvious that signals received by a mobile unit at any given position should be of the same volume whether they come from the headquarters microphone or from another car. To accomplish this the headquarters operator can change the volume of the outgoing signal by use of the receiver volume control, during feedback operation.

Preliminary adjustments for this condition are made as follows:

Tune in any signal on the "ultra-high" receiver.

Adjust volume of headquarters speaker to normal value.

Switch in feedback circuit.

Adjust R_1 until modulation meter shows normal value.

This, in many instances, will be satisfactory. As a matter of common courtesy, these tests should be made during a relatively quiet period, to reduce interference, which is always annoying on police bands.

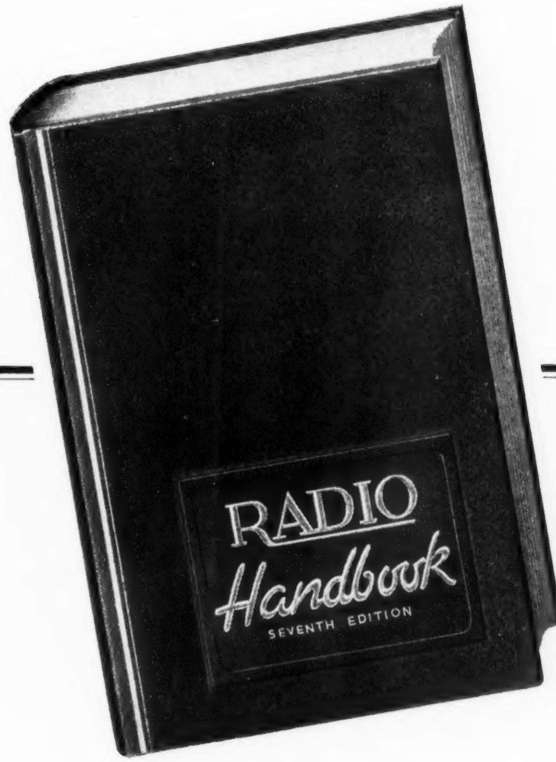
Final adjustments are made by having one patrol car talk to another, via the feedback system. These, like the preliminary adjustments, should be made during a relatively quiet period.

It will be noted, from reference to figure 1, that if the headquarters operator forgets to disconnect the feedback system after need for it has passed, the headquarters transmitter will function as usual, but will emit an unmodulated carrier much of the time. If desired, the unused elements of the switch can be connected to actuate an indicator lamp or other alarm.

Alternative Attenuators

Although the potentiometer—fixed resistor attenuator shown in figure 1 works perfectly well, several other attenuators are just as satisfactory. One of these is shown in figure 2. Here, in place of a potentiometer and one fixed

TOPS!



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THE EDITORS OF RADIO

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resistor, two fixed resistors and one variable resistor are used. The variable resistor should have a maximum value of about 5,000 ohms and the fixed values will have to be determined by "cut and try," the optimum resistances depending on the other circuit components.

Another attenuator, in this case in the low impedance line, is shown in figure 3. The resistors here are 30-ohm rheostats. This, theoretically, is best suited for the transmitter end of a long line, as it produces the best signal-to-noise ratio at this position.

Systems quite similar to the one described above are in use in several cities. They have greatly increased the efficiency of the police radio system in the type of work for which police radios are most needed.

Converting the Ten-Meter Rotary to Twenty

[*Continued from Page 39*]

pipe as possible. The bend is not made too sharp, and takes about 12″ of pipe. The pipe should be bent almost at right angles, so that the "give" or sag in the horizontal element will cause the vertical piece to hang straight down. This will have to be determined by experiment. The angle of bend can be changed easily by slipping a larger piece of pipe over the bent portion and applying the leverage in the direction you wish to change the angle of bend.

After the pipe had been bent, the sleeve couplers were slipped over the bent end of the tubing. Then, with a special tool provided for the purpose, the couplers were crimped to the pipe. Returning to the shack, the ends of the couplers were soldered to the tubing, giving a much better electrical connection and at the same time adding a good deal to the strength of the joint.

Next in order was determination of the length of pipe to be added to the ten meter elements to bring their total length up to that required for twenty-meter operation. It was calculated that for a frequency of 14,200 kc. our radiator should be about 33 feet in length. As the ten-meter radiator was approximately 16 feet long, each vertical section of the new radiator would have to be about 8½ feet in length. After 18 inches had been cut from the straight end of each radiator extension, the sleeves were slipped over the ends of the ten-meter radiator, bolted (or crimped if your electrical dealer will loan you the special tool), soldered, and then replaced on the tower.

The reflector and director were constructed in the same manner as the radiator.

The array is fed with a 625-ohm line into a quarter-wave section of EO-1 cable about 11 feet long; the radiator is split at the middle, and the EO-1 section is terminated at this point.

After the beam had been completed, it was tuned in the usual manner. It was found that all elements were too long for the frequency, each element having approximately twelve inches too much length. For example, the radiator was finally cut down to 32 feet for 14.2 Mc.

Results have been more than gratifying, to say the least. It was not expected that the beam would show up as well as the conventional type, but receiving and transmitting tests show a remarkable discrimination between sides and back-to-front. Also, I now find it possible to carry on a 100% QSO in about 90% of those started, and the 125 watt station at W6CKD is being well received in all eastern and mid-western districts. On several occasions I have been accused of running a good deal more than 125 watts, which, of course, is very pleasing to the vanity!

All in all, the investment of less than four dollars, plus six or eight hours of labor, have more than been repaid. There is also the satisfaction of not having to look up at that useless ten-meter beam with the wish that so much time and money had not been spent in putting it up. Further, should I ever want to go back to the ten-meter beam, there will be no expense and very little labor in doing so.

Yarn of The Month

[*Continued from Page 64*]

Tommy's tonsils—the pompadour—maybe she had something there. Think of the conversations we could have!

"Besides," she continued, "there are worse things, you know. Radio does keep our husbands home."

Home! I turned away. Yes, radio did keep our husbands home. While other ladies' husbands golfed, played poker, Sea-Scouted, Boy-Scouted, or supper-clubbed, *amateur radio kept our husbands home.* I had never thought of that. The world, as always, was still full of a number of things. Every man had to have something to keep the little boy in him alive; it is just as well that we wives remember that.

The speaker was repeating, "Ham Haven will be an ideal spot for hams from all over the world!" Ham Haven—I wiped my eyes. It was my haven, too. I was and forever would be an amateur radio operator's wife.

A Home Built A.C. and Vibrator Power Supply

[*Continued from Page 33*]

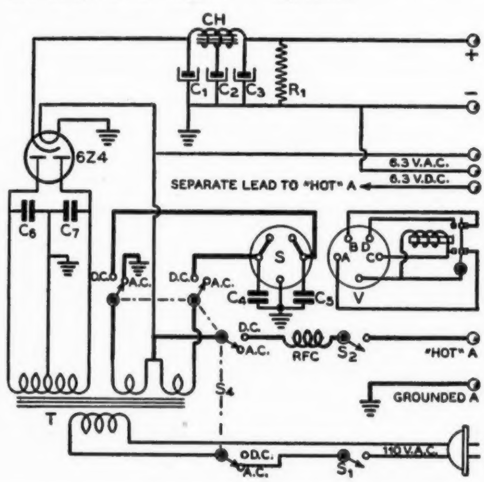
The Vibrator

The vibrator is one of the type originally intended for synchronous use. However, by connecting AC and BD in parallel, the vibrator may be used as a non-synchronous type having double the contact area of the original unit.

A visit to a local radio junk shop will bring to light vibrators that, while useless in a power pack for which they were originally intended, can readily be adapted to the needs of this power supply. For instance, in a pack using a synchronous vibrator a blown filter condenser on the high-voltage side will result in serious burning or welding together of contacts B or D on the vibrating arm. This type of vibrator can be utilized by removing the offending contacts and using contacts A and C as a non-synchronous vibrator. The leads from the transformer to contacts A and C should be reversed and the connection used which gives the highest secondary voltage.

Wiring diagram of the 6.3-volt d.c. or 110-volt a.c. power supply.

C_1, C_2, C_3—8-µfd. 450-volt electrolytic
C_4, C_5—0.1-µfd. 400-volt tubular
C_6, C_7—.006-µfd. 600-volt tubular
R_1—75,000 ohms, 2 watts
T—Power transformer with two 6.3-volt or 6.3- and 5-volt filament windings. See text.
CH—30-hy. 60-ma. tapped choke
RFC—15 turns of no. 12 enam. on 3/8" dia. form
V—Synchronous or non-synchronous vibrator, see text.
S—Vibrator socket
S_1—S.p.s.t. toggle
S_2—S.p.s.t. toggle, 10-amp. rating
S_3—Four-pole double-throw tap switch



Hash Suppression

All vibrator supplies are prolific hash generators and this one is no exception. For that reason the power supply should be thoroughly shielded and the r.f. choke and by-pass condensers shown in the diagram must be used. The filament power for whatever unit the supply is used to power should be taken directly from the battery rather than through the power supply, thus eliminating the trouble from leads common to the filament and vibrator circuits.

An ordinary 4-pole, double-throw rotary transceiver-type switch makes the change from a.c. to d.c. operation. This switch will carry the required current, but should not be switched under load. The off-on switch in the A hot lead should be rated to carry at least 10 amperes. An ordinary toggle switch will serve for S_1, the

[*Continued on Page 77*]

What's New . . . . IN RADIO

LIVE-BRACKET AND DEAD-BRACKET TYPE OHMITE RESISTORS

Ohmite wire-wound vitreous-enameled resistors are available in "live" bracket and "dead" bracket types for special applications.

The "live" bracket type resistors have flexible leads connected to tin-plated brass brackets. They are designed for mounting and making electrical connection by bolting the slotted brackets to panel terminals.

Ohmite "dead" bracket type resistors are mounted by bolting to the brackets. Electrical connections are made separately to the lugs. The brackets for one, two or three resistors are mounted to the resistors by means of through-bolts. The leakage distance from lug to bracket can be regulated by the use of mica washers or by having the lugs located as far in as required. These resistors are obtainable from the Ohmite Manufacturing Company, Dept. 10, 4835 Flournoy Street, Chicago, Illinois.

NEW RCA PORTABLE AVIATION RADIO RECEIVER

A highly-efficient portable radio receiver which receives such important aviation information as CAA weather reports, radio range courses, and airport control tower signals, in addition to standard broadcast programs, has been announced by the Aviation

[*Continued on Page 82*]

U. H. F.

[*Continued from Page 54*]

Francisco, the latter moved away from a gas pump and was no longer heard. CLV has a neon tone oscillator in his rig to help hook weak stations.

The 112 megacycle gang in Tucson are seriously looking for better receivers. W6OVK finds that the 1232 as a mixer is slightly better than the 7V7. He uses a 6C5 oscillator, converting to 20 Mc. and following it with a 6C5 superregen second detector. He wants to try an acorn r.f. stage up in front but the old question of the five dollars keeps popping up. It is the same at W6SLO who wonders if coaxial lines are much help with standard tubes. SLO gets about 15 watts out of rod controlled 76's. OWX and QAP have transceivers which block OVK's superhet-superregen at two miles.

Question and Answer Department

The questions asked this month either require some figuring or are best answered by letter, not being of general interest. It is expected that the Department will be resumed in the next issue. Mail replies will be sent as soon as time permits, to give better service.

U.H.F. Supplement

Last minute letters to this department add several reports and some more recent data on band openings. On May 10, W5HTZ in Cromwell, Oklahoma, was just completing a concentric-line-tuned receiver and was going over the band when he heard a signal. After a hurried switch of his transmitter to five meters, he worked W1HDQ KLJ W2DDV BYM LRE BRI W3GUF DI GNA HOH CGV OR HDJ HFY IIS GSX W8TTL OMY RUE QQS DDO. After three hours, he left home and returned nearly three hours later to work W8TBN W9DYH FFV and one unidentified station. This same day, W6QG in Santa Ana, California, worked W5AJG VV W9CJS ZQC.

The next day, the 11th, W5HTZ heard some W9's but was away from the transmitter. W6QG raised W5HTZ (what, when he was away from the rig?) W5AFX HYT AJG CHG and heard W9NFM in Iowa. The 13th brought W6QLZ OVK in at HTZ but he did not get shifted in time for a contact. The 16th brought HTZ a contact with W3FJ during poor ten meter conditions.

May 19 got W6QG a 450 mile (rather short)

[*Continued on Page 85*]

56 Mc. DX HONOR ROLL

Call	D	S
W9ZJB	9	28
W9USI	9	24
W9USH	9	18
W9AHZ	9	16
W5AJG	9	35
W1DEI	8	20
W1EYM	8	20
W1HDQ	8	26
W2GHV	8	24
W3AIR	8	24
W3BZJ	8	27
W3RL	8	29
W6QLZ	**8**	**22**
W8CIR	8	32
W8JLQ	8	
W8QDU	8	25
W8QQS	8	17
W8VO	8	
W9ARN	8	17
W9CBJ	8	
W9CLH	8	
W9EET	8	15
W9VHG	8	
W9VWU	8	16
W9ZHB	8	29
W2AMJ	7	22
W2JCY	7	
W2MO	7	25
W3BYF	7	22
W3EZM	7	24
W3HJO	7	
W3HOH	7	17
W4DRZ	7	22
W4EDD	7	
W4FBH	7	17
W4FLH	7	18
W5CSU	7	
W5EHM	7	
W5HTZ	**7**	
W8CVQ	7	
W8OKC	7	12
W8PK	7	9
W8RUE	7	18
W9AQQ	**7**	**20**
W9BJV	7	15
W9GGH	7	
W9QCY	7	15
W9IZQ	7	14
W9SQE	7	22
W9WAL	7	
W9YKX	7	15
W9ZQC	7	16
W9ZUL	7	18
W1LLL	6	24
W1CLH	6	13

Call	D	S
W1JFF	6	11
W1KHL	6	11
W1JJR	6	17
W2KLZ	6	
W2LAH	6	
W5DXW	6	10
W5VV	6	18
W6OVK	6	14
W8LKD	6	11
W8NKJ	6	16
W8OJF	6	
W8PKJ	6	12
W9NY	6	13
W9CJS	6	
W1GJZ	5	15
W1HXE	5	18
W1JMT	5	9
W1JNX	5	12
W1JRY	5	
W1LFI	5	
W2LAL	5	11
W3CGV	5	10
W3EIS	5	11
W3GLV	5	
W3HJT	5	
W4EQM	5	8
W6DNS	5	
W6KTJ	5	
W8EGQ	5	10
W8NOR	5	16
W8OPO	5	8
W8RVT	5	7
W8TGJ	5	9
W4FKN	5	9
W9UOG	5	8
W9WWH	5	
VE3ADO	4	
W1LKM	4	6
W1LPF	4	16
W3FPL	4	8
W6SLO	4	6
W6IOJ	4	7
W6QG	**4**	**9**
W7GBI	4	6
W8AGU	4	8
W8NOB	4	
W8NYD	4	
W8TIU	4	8
W9PK	4	6
W5AAN	3	5
W6AVR	3	4
W6OIN	3	3
W6PGO	3	6
W7FDJ	3	3
W8OEP	3	6
W9WYX	3	3

Note: D—Districts; S—States.

The Open Forum

Rockland, Mass.

Sirs:

The following list of new hams for OMRC was received since the last list was published. Requests for membership have been coming more slowly, but it can't be possible that we have reached saturation yet. There must be some other reason. I wonder if W9CAB is the oldest ham at 85. I haven't heard from any one who claims to be older. I also wish to thank those who sent me a card on my birthday, January 14th. I was 64 years young —a man with a hobby.

W1LTT—Mar. 1—1889
W3FM—Dec. 30—1890
W5WX—Dec. 25—1884
W6PNM—Mar. 8—1883
W7CDS—Oct. 18—1876
W8VQX—Sept. 19—1882
W8VAV—Aug. 10—1888
W9OQV—Oct. 12—1889
W9FEW—Sept. 6—1890

Any active ham who is 50 years of age or older is eligible for membership in this club. Just send me your card with date, month and year of birth. You become a member of the OMRC on receipt of your card. That's all. We have 192 members at present.

CHARLES F. LOUD, W1JIS.

With the Experimenter

[*Continued from Page 59*]

CONTROL OF F.M. RECEIVER READABILITY

By PERRY FERRELL, Jr.*

The usual limiter circuit employed in f.m. receivers consists of a tube with a sharp cut-off characteristic which is operated as a grid-cathode rectifier. The tube therefore develops a bias voltage negative to ground on a resistor in the grid return circuit. This resistor generally has a value of from 5,000 to 25,000 ohms, according to the manufacturer's preference. It can be seen that below the point where this limiter has completely levelled off the input (i.e., perhaps below 5 volts) the signal-noise ratio will go down due to the reduction in the limiting action.

It is quite possible in amateur work that many signals will be encountered that fall into this range. To improve the weak-signal noise response, the resistor in question has been removed and a good 50,000-ohm potentiometer has been substituted to give a degree of control over the point at which limiting action begins.

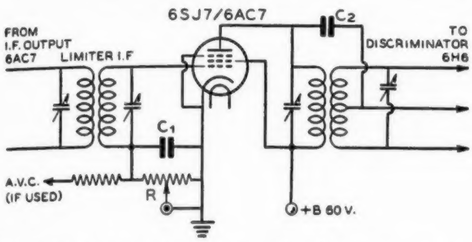
In use, decreasing the value of resistance in the grid circuit will vary the limiter grid current flow, until an optional value between 2,000 and 5,000 ohms is found where the extremely weak signal may be read well into the rush. This weak a signal would be lost if the resistor value was held constant at 20,000 ohms. Further reduction of the resistance below 2,000 ohms will cause a degree of distortion and then finally complete cut-off of rush and signal.

On signals of different strengths various resistance values may be employed, with about 20,000 ohms providing the best ratio on primary service area signals. On unmodulated carriers of fair strength varying the grid resistance will vary the limiter grid current somewhat. On tests made by ear, a very slight hiss will persist when the resistance is too low and a slight increase in the residue noise and rush level will be noted if the resistance is too high for that signal. At a certain value complete and effective limiting will occur.

Some improvement on weak signal response can be made by substituting a 6AC7 for the usual 6SJ7. The use of the variable

*107 East Bayview Ave., Pleasantville, N. J.

resistance can be applied with greater efficiency to circuits using the 6AC7 tube.



The grid leak resistor which ordinarily appears at R is replaced with a potentiometer of 25,000 ohms. The condensers C_1 and C_2 are conventional for the circuit and are not changed.

FCC Ruling on Equipment "Loaned" to Amateurs

The defense committee of a certain Massachusetts municipality contemplates the purchase, with town funds, of radio apparatus which is intended to be given or loaned to local amateurs for use in emergencies. The committee wants to know whether such service is compatible with Federal Communications Commission rules pertaining to amateurs. The Commission makes reply:

"It appears that ownership of the equipment would remain in the - - Defense Committee and that the procedure outlined in your letter is contemplated to circumvent the prohibition in Section 12.62 of the Amateur Rules against issuance of amateur licenses to corporations or associations. From the information submitted it does not appear that acceptance of the radio equipment by local amateurs would constitute remuneration for their service in emergencies within the contemplation of Section 12.102 of the Amateur Rules. Attention is called, however, to the fact that it would be necessary for the amateur or amateurs operating this equipment to be in complete control thereof. In order that control may be vested in such operators, it is suggested that the equipment be leased to the amateurs at a nominal sum for a definite period of time, such as one year. Such lease agreements should contain, among others, a statement to the effect that sixty days' notice will be given to this Commission in the event of their termination, and copies thereof should be submitted with applications for station licenses. Operation of such apparatus must, of course, be carried on strictly in accordance with the Commission's Rules Governing Amateur Service.

"It is believed that police radio or special emergency radio stations licensed in the Town of - - - in its own name would possibly be of more benefit to the town in cases of emergency than would amateur stations furnished to individuals or organizations, as no control could be maintained by the town of the apparatus thus operated."

A Home Built A.C. and Vibrator Power Supply

[*Continued from Page 73*]

110-volt off-on switch. In order to realize the full output from the power supply it is important that the leads from it to the battery should be as short and as heavy as possible.

Why Every Amateur Should Be a Member of A.R.R.L.

[*Continued from Page 44*]

10. It initiated cooperation with F.C.C., the Army, Navy, N.Y.A., C.C.C., and other government agencies in providing trained personnel from amateur ranks for posts created by defense needs.

11. It secured extension of licenses for amateurs where delay in issuing renewals because of excessive burdens placed on the F.C.C. was forcing them off the air. (Orders 76 and 76-A.)

12. It secured extension of period provided for operation under portable status while awaiting modification of license. (Rule 12.93 a.)

13. It was instrumental in expediting issuance of licenses to new applicants when serious administrative difficulties arose.

14. It secured suspension of the "proof-in-use" rule for benefit of amateurs seeking renewals whose licenses would otherwise expire while in military service. (Order 77.)

The above record covers only two past years. Those years were critical, but the problems to be encountered in the coming year unquestionably will be equally important. What these may be cannot be predicted; the one thing certain is that A.R.R.L.'s representatives will be constantly on the job.

Only because of strong organization and loyal support has American amateur radio successfully negotiated the past critical months. Such alert representation, coupled with a strong, united membership, alone can keep amateur radio on the air and enable amateurs to make their maximum contribution to the present national effort. It is up to every amateur to support this program by his membership in the League.

Of course, there are other reasons for joining the League, too. There are a variety of membership services, such as the Technical Information Service. There is the Communications Department, which sponsors a variety of operating activities for both training and pleasure. There is the important advantage of eligibility to vote in A.R.R.L. elections for director and S.C.M. and to hold field appointments and elective posts in the extensive A.R.R.L. organizational structure.

But the reason that seems to me now to be of overwhelming compelling importance is that of lending support to the unified strength of amateur organization. I need hardly say that at any time I would urge amateurs to join the League. But today I put that plea on the basis of duty—duty to oneself as an individual and to amateur radio as a whole.

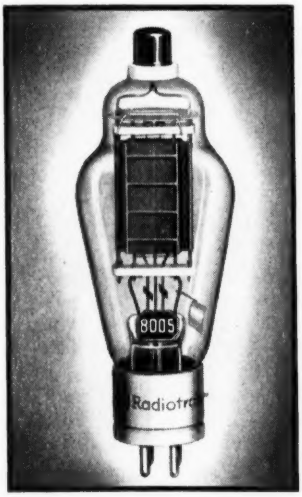
X - DX

[*Continued from Page 48*]

latter part of June will find the x.y.l. and the o.m. around the east coast back to California. I hope all of youse guys have a swell summer. And I, also, hope we'll be together with X-DX when the October issue rolls around.

New Tubes

[*Continued from Page 42*]



8005

The 8005 is a transmitting triode suitable for r.f. or a.f. use and having a plate dissipation rating of 85 watts. This new tube is physically no larger than the familiar 811 and 812, but offers considerably more than these tubes in the way of output capabilities. Part of this increased capability can be attributed to a zirconium-coated molybdenum anode and a hard-glass envelope. A single tube may be operated in unmodulated class C service with an input of 300 watts and with a driving power of only 7.5 watts.

CHARACTERISTICS AND RATINGS

Filament Voltage	10 Volts
Filament Current	3.25 Amp.
Amplification Factor	20
Direct Interelectrode Capacitances	
Grid-Plate	5 $\mu\mu$fd.
Grid-Filament	6.4 $\mu\mu$fd.
Plate-Filament	1 $\mu\mu$fd.

[*Continued on Page 92*]

NEW BOOKS
and trade literature

New Allied Catalog

The new Spring and Summer catalog for 1941 of Allied Radio Corporation, 833 West Jackson Boulevard, Chicago, Illinois, has just come off the press. The 176 page book is profusely illustrated throughout. The five main sections into which the catalog is divided are: home receivers and radio-phonograph combinations, components for radio servicemen and constructors, public address equipment, transmitting tubes and components for amateurs, and tools and supplies. Copies of the new catalog are obtainable for the asking by writing to the above address.

Premax Antenna Manual

The Premax Products Division of Chisholm-Ryder Co., Inc., Niagara Falls, N.Y., has just published an Antenna Manual which should be of considerable interest to amateurs, police radio technicians, and others who work with u.h.f. communication. The book, 8½" by 11" in size, contains 32 pages of information which is profusely illustrated with 51 diagrams of verticals and rotary arrays. Arthur H. Lynch, W2DKJ, is the editor of the book. Copies are 25c, postpaid, and can be obtained by writing to Premax products at the above address.

A Low Powered Police Transmitter

[*Continued from Page 29*]

cord is plugged into the mains the filaments are never off. The third, or control wire, is controlled at the speech amplifier where it turns on both the power supply for the speech amplifier and the transmitter.

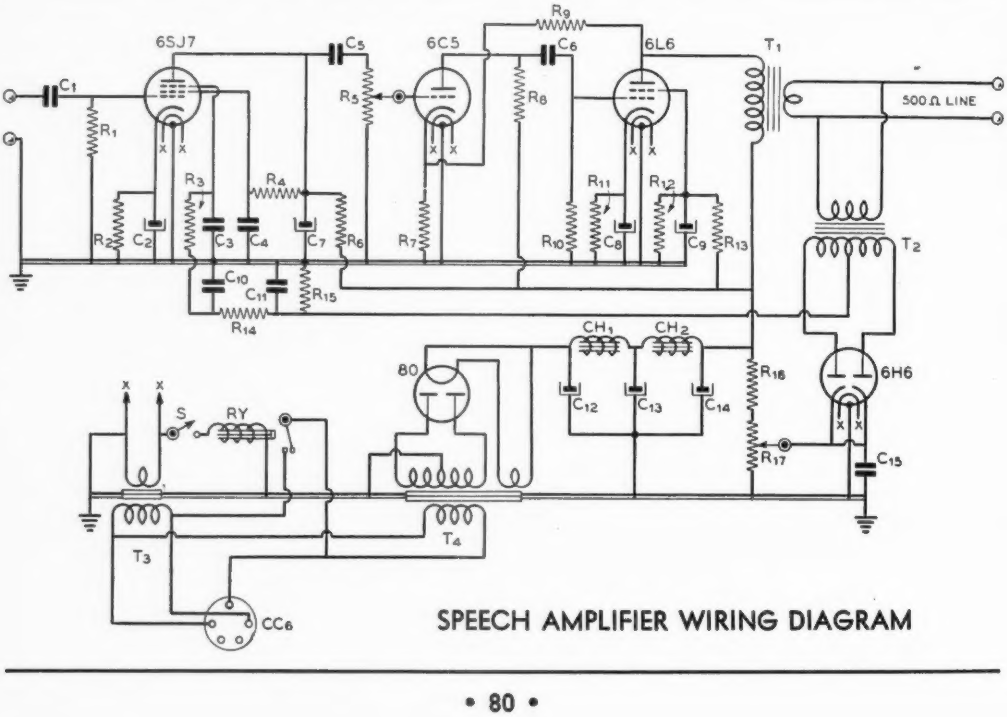
The Speech Amplifier

The speech amplifier should be of interest to the amateur in that it is small, contains a compression circuit, and yet has plenty of drive to obtain a 100-watt output from the modulators. It was found also to be completely hum-free and without a single "bug." The author has always been partial to separate speech amplifiers. They have several advantages in that they are isolated from the r.f. section, they allow a greater amount of flexibility, and it is possible to use one amplifier on several rigs. The compression circuit in this speech amplifier worked out as well as could be expected. Time did not allow exhaustive checks with a 'scope, but to the ear the compression was quite effective and seemed to limit blasting to a considerable extent.

As stated above, the control circuit is located in the speech amplifier; inspection of the diagram will show how simple it is.

The Receivers

The receiving installation consists of two low-frequency receivers (Sky Champions in this



SPEECH AMPLIFIER WIRING DIAGRAM

case) with a few minor changes adapting them to this work. Q circuits were installed in both the 1682 kc. and 2414 kc. receivers to silence them when no signal was being received. These receivers proved very sensitive and do their work well; with the few changes made they make very good station receivers. They both use the transmitting antenna for receiving.

The third receiver is an RCA ultra-high car receiver operating on 30,580 kc. All three receivers, the r.f. section, the power supply and modulator were contained in a single cabinet. The back view shows the clean-cut arrangement. The antenna used both for transmitting and receiving is an L Marconi, and the transmitter is coupled through a short coaxial line to an antenna inductance. The system can be used either for 50-watt operation or for 100-watt operation simply by changing from 750 volts to 1000 volts, and increasing the antenna coupling slightly.

The quality was found to be above the average of that for police stations, and preliminary checks indicate that results will be all that were expected. In checking the output on the 50-watt job, it was found that a 75-watt lamp burned normally bright with 100 watts into the final amplifier. Tuning was found to be very clean, and no trouble has been experienced in keeping it in efficient operation. All parts are much larger in rating than is necessary, but it was felt that underloading of parts was desirable.

The last portion of the installation consists of the transmitter and receivers installed in the cars. The transmitters are Stancor M-30, and the receivers are Philco 821-Ps.

Speech Amplifier Wiring Diagram

C_1—0.01-μfd. 400-volt tubular
C_2—10-μfd. 25-volt electrolytic
C_3—0.1-μfd. 400-volt tubular
C_4—.01-μfd. 400-volt tubular
C_5—.05-μfd. 400-volt tubular
C_6—.05-μfd. 400-volt tubular
C_7—8-μfd. 450-volt electrolytic
C_8—10-μfd. 25-volt electrolytic
C_9—8-μfd. 450-volt electrolytic
C_{10}, C_{11}—0.1-μfd. 400-volt tubular
C_{12}, C_{13}, C_{14}—8-μfd. 450-volt electrolytic
C_{15}—0.1-μfd. 400-volt tubular
R_1—1 megohm, 1/2 watt
R_2—100 ohms, 1/2 watt
R_3—250,000 ohms, 1/2 watt
R_4—1 megohm, 1/2 watt
R_5—500,000-ohm potentiometer
R_6—10,000 ohms, 1 watt
R_7—1500 ohms, 1/2 watt
R_8—50,000 ohms, 1 watt
R_9—150,000 ohms, 1/2 watt
R_{10}—500,000 ohms, 1/2 watt
R_{11}—250 ohms, 1 watt
R_{12}—30,000 ohms, 10 watts
R_{13}—20,000 ohms, 10 watts
R_{14}, R_{15}—250,000 ohms, 1/2 watt
R_{16}—100,000 ohms, 1/2 watt
R_{17}—50,000-ohm potentiometer
Not shown in the diagram is a 250,000-ohm, 1/2-watt resistor in series with the lead from the junction of R_4 and R_6 to the plate of the 6SJ7.
T_1—Output trans., 6L6 to 500-ohm line
T_2—Plate-to-push-pull-grid trans.
T_3—6.3 v., 2.5 a.
T_4—700 v., c.t., 150 ma.
CH_1, CH_2—12 hy., 150 ma.
RY—S.p.s.t., 6.3-v. coil
S—S.p.s.t. toggle

What's New

[*Continued from Page 74*]

Radio Section of the RCA Manufacturing Company.

The new receiver, housed in a sturdy two tone airplane fabric covered case, is equipped for three-way operation—on self-contained dry batteries, in a plane, or from an a.c. or a d.c. electric outlet at home, in hotels, etc.

Unusually sensitive and selective for a portable receiver, the unit has a 6-tube, 2-band superheterodyne chassis equipped with a built-in static-limiter switch to bring in weak signals above stormy noise levels and to reduce possible engine interference. Its many other features include tuned r.f. stage, rubber mounted chassis to withstand shock and vibration, and built-in loop antenna. Unusually good tone is provided by a large permanent magnet dynamic loudspeaker.

When used in a plane, the AVR-102 is ready for operation when connected to the ship antenna. A convenient jack is provided for headphones. The inexpensive, easily installed dry batteries provide for as many as 200 hours of operation.

One unique feature of the receiver is the rugged new metal speaker grill. It is designed and stamped for efficient acoustic response and finished in burnished bronze. The case is covered with two-tone airplane fabric. Rubber feet are provided for the bottom of the case.

A simultaneous radio range filter is also available. This permits clearer reception of weather broadcasts and other voice transmissions without interference from the radio range signals upon which the voice transmissions are superimposed.

NEW-TYPE CODE PRACTICE OSCILLATOR

Airadio, Inc., 2 Selleck Street, Stamford, Conn., has recently announced a new type of code practice oscillator which should be of interest to those engaged in the code instruction of large groups of students. The unit consists of a crystal-controlled r.f. oscillator, with self-contained power supply and key, which gives the student exactly the same type of signal which he will be required to copy in regular communications work. The signal is actually tuned in on a regular receiver in the same manner as would be some distant station. It can be used on any frequency by inserting the proper crystal and plug-in coil. It is directly operated from 110 volts a.c. or d.c. and uses a 117L7-GT as combined rectifier and oscillator.

[*Continued on Page 87*]

Two Frequency Stub Matching

[*Continued from Page 38*]

be changed in small steps—to avoid passing over the optimum point—and the stub or coil changed through a number of sizes for each position. It will soon be evident in which direction and how far the proper adjustment will deviate from the data given in the tables. The final adjustment should produce a standing wave ratio of less than 1.06 to one—much better than the two to one ratio that is often considered to be satisfactory. On lines that are only two or three wavelengths long, a ratio of 1.20 to one may not cause any noticeable sacrifice in operating characteristics except in some cases an inability to load the transmitter properly.

Upon completion of the adjustment it is often advisable to provide lightning protection and reduce harmonic radiation by grounding the shorting bar, if a closed stub is used.

Adjustment For Two Frequencies

If it is desired to match the antenna for a second frequency, the transmitter is shifted and the new minimum current point and ratio are determined. The same process is followed, using a closed stub to eliminate the standing waves. After the adjustment has been completed, the stub may be built out to a full quarter wavelength at the first frequency as shown in figure five, so it will have no reactance at that frequency and this quarter wave stub readjusted (but keeping it at the same point on the line) to take care of the capacitive reactance of the addition to it. Then the system should be rechecked for standing waves at both frequencies.

It is contemplated that more detailed data on matching at two frequencies will be presented in an early issue.

The general theory presented here can be applied to concentric lines in an unbalanced circuit, if the line is large enough to withstand the peak voltage encountered beyond where the system is matched. The method can also be used to reduce standing waves on a system using other matching means.

Trouble Shooting

In some cases, it has been impossible to reduce standing waves below perhaps a two to one ratio. Sometimes this has been accompanied by a displacement of the current node along one wire of the line, due to capacity coupling to the transmitter or pick-up of radiated energy on the line itself, which in a balanced system can be caused by *in-phase* current flowing in *both* wires. Another source of trouble can be parasitic oscillations or harmonic power which may appear in the transmission line as additional standing waves that the system does not eliminate, and which may obscure the proper current minimum.

Additional References

Sterba and Feldman, "Transmission lines for short wave antenna systems." *Proc. IRE,* July, 1932, p. 1163.

Conklin, "Transmission lines as circuit elements." RADIO, April, 1939, p. 43.

Conklin, "Why some beams don't work." RADIO, Jan., 1938, p. 121.

The Story of KD4GYM

[*Continued from Page 12*]

A few words about the work carried on at the Swan Island weather station may help to explain the actions of KD4GYM, or any other ham station operating from this location in the future. Regular six-hourly weather observations are made at Swan Island. Besides this, twice-daily pilot balloons are sent up to gain data on the upper air winds. Every night a large free balloon with a radio-meteorograph attached is released. During the flight of this balloon into the stratosphere the small ultra-high frequency transmitter transmits to the receiving equipment at the station data on the pressure, temperature, and relative humidity. Transmission of data from these observations to forecast centers requires that four radio schedules be maintained daily with Navy stations. Add to all this the work of summarizing data, the installation of new station equipment, and the maintenance of all station meteorological and radio equipment and maintenance of the power plants. One can get some idea of how much, or rather how little time there is left for ham radio.

On many occasions while operating on the ham band it became necessary to QRT because it was time for one of these observations, or perhaps for a Navy radio schedule. These observations and schedules are set at specified times and can not be put off. Often there were several stations calling KD4GYM at the time. Realizing how much a contact with a new country means in these times of scarce DX, we always made an effort to answer calls whenever possible. But when work was pending, it was necessary to QRT without answering everyone calling. Doubtless this caused some grumbling among the ranks of those so anxious to bag a new country. A similar situation will most likely occur often in the future as long as there is a ham station operating at Swan Island. So if you happen to be the disappointed station calling, please remember he isn't deliberately ignoring you. So before you call the poor fellow such names as "The Sultan of Swan Island," just cool off a little bit and consider the possibility of those skeds failing due to conditions on the band, and remember that he hasn't "got it in for you" because you live in Podunk Hollow, or any other place. Please keep in mind the true conditions affecting his actions.

Very amusing was the way in which the over-anxious DX hounds frequently spoiled each other's chances of a contact by piling on top of each other's frequency and calling before a QSO was finished. Had the courtesy of QRX-ing until one station was finished been observed, no doubt many more contacts could have been effected in the time wasted combating the QRM. Not so amusing, though, was this practice while we were attempting to carry out schedules with stations in home towns of our personnel. On the other hand, many fellows were quick to QSY or QRX as soon as they became aware of the fact that they were causing interference. Had these stations not been greatly in the majority considerably fewer successful QSO's would have resulted.

All stations receiving a QSL from KD4GYM owe a vote of thanks to W1FH. Learning of our sad predicament, isolated on a lonely island with no cards, Charlie immediately offered to have a bunch printed for us. Thereafter whenever more cards were needed, we had but to place our order with W1FH and we were sure to get them. Our vote of thanks also to W7ABB, W6QD, and W5EGA who very willingly offered their help in addressing cards. Without their help the job would have required a much longer period of time, mostly due to the fact that Swan Island seriously lacks in a supply of y.l. stenographers, blonde, brunette, or red-head.

Too numerous to mention individually are the stations which at various times assisted us by relaying traffic, or helping us to get hooked up with some other station. Had it not been for the 100% cooperation of the twenty-meter gang we would not have been so successful in securing and maintaining contact with the stations in the various home towns of our station personnel. Be assured, such contacts are greatly appreciated by anyone isolated as are those on Swan Island. KD4GYM will be heard no more from Swan Island, but KD4HHS is operating from Swan Island at the present time and other calls will be issued to hams operating from the same QTH in the future, assuming no further changes in F.C.C. regulations. The cooperation of the gang in their willingness to QSP, QSY, QRX, QSO, etc., will always be appreciated by a KD4 operating from Swan Island.

• • •

S. W. Call is W1LUT.

Buddhist Llamas claim a mental communication system that rivals radio in speed and distance.

W1JR and WJAR are in the same city.

U. H. F.

[*Continued from Page 75*]

contact with W6OVK in Tucson, and contacts with W5WX CHG HYT. W6QLZ heard W7ERA. W9AQQ in Indianapolis worked W1KLJ SI.

On the 20th, QG worked W7HEA, hearing W5AJG AFX, while W6QLZ worked W9CCY QPK and heard W5HTZ. W9AQQ raised W5AJG EHM. The next day, the 21st, was good for contacts with W7CIL ACD at W6QG QLZ raised W9ZQC YKX USI and heard W5VV W9CJS. The band was open on the 30th at W6OVK who heard W5VV HTZ. On the 31st, OVK worked W7FFE FDJ AMX ERA; W6QAP got W5AAN and heard W3IIS in a W2 contact; W8FGV says the W5's were in, with HTZ best.

June 1 was quite a day for W5HYT (on 57,200), W5CHG (57,040) and W5WX (57,-232) in Amarillo, Texas. Signals were heard all the way up to 59,960 with plenty of QRM especially at 57 megacycles. WX went across the band and found 47 stations transmitting at the time, apparently all one hop to W8 and to the more distant W9's. CHG raised W8QXV. WX got W8CZA QQP CIR W9QCY. HYT hooked W8CIR QXV CZA OPB QQP ARF KKD W9RRX PK, making recordings of the contacts, then added QSO's with W8BIO JLQ TIU W9AQQ WWH. No calls heard were listed, due to the large number. W8FGV in Barberton, Ohio, heard W5-6-9 on this day.

The Texas-Oklahoma-Arkansas gang has found itself on ground wave dx at last. W5AJG has been making daily contacts with Texarkana and Cromwell, Oklahoma (he says that they both are 165 miles away). On 75 meter phone, W5HTZ in Cromwell made a schedule with Texarkana (195 miles, he says) on five and connected with W5BDB DXW there on the same night, working them until they signed for a contact with AJG in Dallas. Then HTZ worked AAN in Denton. For a week, Texarkana was worked all but two nights and Dallas on all but one. W5HTZ is now looking for someone in eastern Kansas (W9VWU?) or western Missouri (W9GBJ ZJB) out to 200 miles with whom to have schedules and hook the Texas gang up to the network that reaches the east coast. W9ZJB made a study of active Kansas stations a while ago and should help. A number of active Kansas stations in Wichita and elsewhere have been mentioned in this column during the past year. HTZ uses a horizontal W6QLZ four element antenna, and a pair of HK24's with 130 watts input.

The dx has helped W5AJG to peak up his

equipment. Tests with AAN (45 miles) showed that each additional 10 feet in antenna height, after the first 25 feet, increased signals both ways by 6 db. They want to know what to do after running out of pole.

W6GBN is back on 57 Mc. with a new QLZ four element beam. QLZ has worked 34 of the stations in the honor roll.

W8FGV in Ohio has put up a horizontal antenna, along with others in his state. They seem to be working farther than they did formerly into Michigan and Pennsylvania (W8JLQ took his down) although others have done that on verticals in the past. The expressed disadvantages with the horizontal are its directivity and difficulty of using it in mobile work. Frank, how about trying that non-directional full wave U-shaped horizontal on your car, mentioned here a short while ago?

W9AQQ in Indianapolis has been holding back on reports, hoping to work all districts first (another W9ZHB?) but he comes through with the news that he has seven districts and "twenty some odd" states with confirming cards from 17. Ground wave work has been good with quite a few stations active up to 250 miles using horizontals, including these:

W9BDL	Marshall, Illinois
W9IOD RRX	Near Chicago
W9HUV	Lafayette, Indiana
W9QCY	Fort Wayne, Indiana
W8NSS	Dayton, Ohio
W8BPQ	Cincinnati, Ohio
W8VIB	Three Rivers, Michigan
W9ANH ZHL OMR	Terre Haute, Indiana
W9UNS	Marshall, Indiana
W9RBK	Newport, Kentucky

The last of these, RBK, has not been worked but is putting up a horizontal and may well do it inasmuch as W8BPQ in Cincinnati across the river has succeeded. W9AQQ uses 250 watts, a three-element quarter-wave spaced, *Q*-bar matched rotary antenna 54 feet high. His frequencies are 56,008 and 57,112. Dx has been slow for him this year, although he has been lucky to get W1's on short skip May 20, though he missed some of the W5-W6 work during the month. It is too late to include his antenna photos in this issue.

2½ METER HONOR ROLL

ELEVATED LOCATIONS

Stations	Miles
W6KIN/6-W6BJI/6 (airplane)	255
W6QZA-MKS	215
W6BKZ-QZA	209
W6QZA-OIN	201
W6BCX-OIN	201
W3BZJ-W1HDQ (crossband)	200
W6NJJ-NJW	175
W1DMV/6-W6HJT (airplane)	165
W9WYX-VTK	160
W6KIN/6-W6OMC/6	140
W6IOJ-OIN	120
W2LBK-W1HDQ	118
W1HDQ-W2JND	105
W6BCX-IOJ	100
W1HDQ-W2IQF	100
W1HDQ-W2GPO	100
W6NCP-OIN	98
W1KXK-MNK/1	81
W6IOJ-OIN	80
W6CPY-IOJ	80

HOME LOCATIONS

Stations	Miles
W1MON-W2LAU	203
W8CVQ-QDU (crossband)	130
W6QLZ-OVK crossband	107
W3BZJ-W1MRF	130
W1IJ-W2LAU	105
W3BZJ-W1LAS	105
W2ADW-W2LAU	96
W1HBD-W1XW (1935)	90
W2LBK-W1IJ	76
W2LBK-W3BZJ	76
W1MWN-W2LAU	75
W1SS-BBM	74
W1KXK-IZY	73
W1MRF-W2LAU	68
W2GPO-LAU	50
W1LAS-W2LAU	45
W1LEA-BHL	45
W1MON-HEN	45
W2JND-LAU	44
W2MLO-HNY	40
W3CGU-W2HGU	40

1¼ METER HONOR ROLL

ELEVATED LOCATIONS

Stations	Miles
W6IOJ-LFN	135
W1AJJ-COO (crossband)	93

28 Mc. Openings

W8FGV in Barberton, Ohio, noticed the comment that although 28 Mc. skip is now decreasing each year, it might be possible that short skip is continuing or increasing. He sends in a daily report of 10 meter work for May in each of the past four years, showing none dead this year compared with 16 dead in 1940, 8 (and he was off four days) in 1939, and 9 in 1938. Some of the earlier years were good for dx rather than for short skip, so this May shows up very well.

What's New in Radio

[*Continued from Page 82*]

RADIO TRAINING COURSE KIT

Allied Radio Corporation, Chicago, offers a new low-priced special 6-tube 2-band a.c.-d.c. training-course kit, Model B9820, that anyone can build, as the particular answer to all N.Y.A., radio school, and other student radio construction problems.

This efficient superhet receiver kit has been especially designed for the radio student, experimenter, and builder. Easily assembled with a minimum of time and trouble, it requires merely a screwdriver, pliers, and soldering iron for its erection. A punched and drilled chassis base is supplied, together with thoroughly complete and simplified instructions in non-technical terms.

This 6-tube 2-band superhet kit incorporates the newest features and developments found in advanced radios, such as: built-in loop; push-button tuning; plastic slide-rule dial; variable tone control; a.v.c.; 2½ watts output; phono, television and f.m. adapter connections. Tuning range for standard broadcasts is 535 to 1,720 k.c., and 5.65 to 18.3 Mc. for foreign and domestic Shortwave. Uses latest multi-purpose tubes: 12A8GT, 12J5GT, 12K7GT, 12Q7GT, 35L6GT, and 35Z5GT. Employs a 6½" PM dynamic-type speaker for realistic reproduction.

A product of Allied Radio Corporation, 833 West Jackson Boulevard, Chicago, Ill.

NEW ECHOPHONE RECEIVER

Another Echophone "Commercial" receiver makes its bow to the radio world in the form of the Model EC-3. Selling in the lower price brackets of the communications type receiver range, it nevertheless presents a surprisingly large number of features of the type found normally only in much more expensive equipment.

Among these features are a tuned r.f. stage on all bands, continuous coverage from 545 kc. to 30.5 Mc., crystal filter, four degrees of selectivity including two in which the crystal filter is in the circuit, crystal phasing control for maximum interfering signal reduction, automatic noise limiter with switch, phone-tip jacks and speaker-phone switch, beat-frequency oscillator with variable pitch control, external PM speaker in matching cabinet, electrical bandspread with calibrations for four ham bands, but usable anywhere in the receiver's tuning range, indirectly illuminated dial scales, and several others.

Other features of the receiver are its provision for operation from both a.c. and d.c. 115-volt lines, and a unique monitor circuit which enables the amateur to listen in on his own c.w. transmissions.

THE TURNER CARDIOID MICROPHONE

The Turner Co., Cedar Rapids, Ia., is announcing the addition of a new Cardioid to their line of microphones. The Turner Cardioid Microphone, using a two element generator to obtain cardioid characteristics, consists of a ribbon velocity element and a dynamic pressure element, combined through

a specially designed transformer network that properly mixes the two elements to obtain high sensitivity to sounds originating in front of the microphone, and extremely low sensitivity to sounds originating to the rear of the microphone.

Through the use of two elements to obtain cardioid characteristics no sacrifice of frequency response need be made as in the single element types which are less expensive to manufacture. The desirable features of the dynamic are here used in combination which the desirable features of the velocity to make the most modern microphone produced by modern engineering.

Further information on Turner's new Cardioid Microphone may be had by writing The Turner Co., Cedar Rapids, Ia.

NEW EICOR CONVERTER

Eicor, Chicago, manufacturers of dynamotors, power plants, converters, and d.c. motors, announce a new converter design. This new unit is more compact, more modern, more convenient for portable or permanent use. It converts direct current to alternating current for amplifiers, projectors, phonographs, radio receivers, transmitters, medical equipment, musical instruments, and other applications. Available for 6, 12, 32, 115, 230 volts, or other standard d.c. input—and have standard a.c. output. All are equipped with ball-bearings. Available with or without filter. Built for high efficiency, quiet operation and long life. For details, write to Eicor, 1060 W. Adams St., Chicago, Illinois.

• • •

Injection Molding of "Mycalex"

Injection molding of Mycalex, a material consisting of ground mica and a specially developed glass, has been announced as a new development in plastics manufacture by the plastics department of the General Electric Company, at Pittsfield, Mass.

Primarily because of its low dielectric power losses, the material is expected to find widespread use in the radio and electronic field and, because of high mechanical strength, heat resistance and dielectric value, in industrial control and heating industries.

Mycalex has been compression-molded for some years in plate and bar form, and machined to require designs by the General Electric Company. It also has been molded by direct compression methods into various important insulating parts such as rectifier seals, and brush holder studs in which metal members are required as integral parts. By the injection process the material can be produced in more intricate shapes and many new applications should result.

In general, G-E Mycalex has better electrical characteristics than porcelain, and has comparable mechanical strength. It is not as refractory as porcelain or mica but is far superior in this respect to the ordinary molded insulations made with phenolic resin, shellac, gums, pitches, and other organic materials. In addition to its high dielectric and mechanical strength, Mycalex has low power factor, high arc resistance, chemical and dimensional stability, and low coefficient of thermal expansion. It is impervious to water, oil and gas and is unaffected by sudden temperature changes. Metallic inserts can be readily molded into the parts.

General Electric is molding several grades of Mycalex which have been applied as tube bases, switch insulation, structural parts in radio transmitters, arc chutes, relay insulators, terminal insulators and as inserts in die castings and organic plastics.

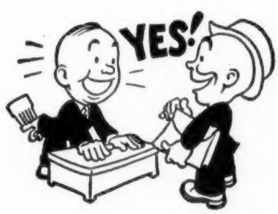
"not even holes . . ."

". . . to fame and Fortune"

(an unsolicited testimonial from Elmer C. Q. Blatt)

"I was destitute. Not even holes in my pockets. Then, one day I remembered that RADIO pays cash for articles. So I wrote down a lot of kinks, wrinkles and gadgets that have been in my mind for some time and went in to see the editor.

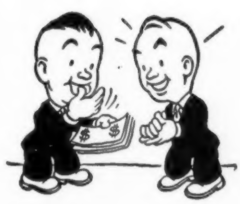
"He jumped down my throat and gurgled, 'Yes, we'll accept them, and any others you can dig up that are as good.' Then he took me down to W6QX, who has charge of the purse strings.



Oh, goody!

"Now I'm a successful author—articles published in black and white with my name at the top, and best of all, money in my pockets!

"Any time I'm short of cash I just dust off the mill and grind out a blurb for RADIO, for which I often get nice soft folding money in return. I get rejection slips, too; I'm papering the shack with them where the QSL cards don't quite cover. But I do like those engraved pictures of Lincoln, Jefferson, and Chase."



W6QX forking over

You'll never get rich, we'll admit, but you can pick up a little extra cash by contributing articles to RADIO, just as Elmer has.

Remember, it's the idea that pays off. Flowery composition won't get you anywhere; it's the idea or the equipment that determines the acceptability.

Get that brainstorm or a description of your new rig down on paper and send it, together with pictures when practicable, to the Editors of RADIO. Here is your chance to break into print and get paid for it.

When an acceptable article is to be run right away, payment is made on publication. If it appears necessary to hold an article for a while because of the recent appearance of similar material, payment is made immediately after acceptance.

And remember, we can use articles on simple equipment and ABC theory as well as more advanced stuff.

Hot Dog!

THE EDITORS OF RADIO — technical publishers

CORPORATE NAME: EDITORS AND ENGINEERS, LTD.

1300 KENWOOD ROAD, SANTA BARBARA, CALIFORNIA

A Directly Calibrated Audio Oscillator

[*Continued from Page 41*]

If this little step is omitted, the dial calibrations will only be accurated when always approached from the same direction. The directly calibrated dial is a National type O, which has been taken apart and had a paper disc cemented on over the metal dial. The paper scale can be calibrated in pencil or ink and lacquered or covered with celluloid for protection.

The actual construction and wiring present no special difficulties. The main trouble will be in getting a good calibration job. If another oscillator which is known to be fairly accurate can be borrowed, all is well, and the unit can be zero beated and calibrated in short order. If not, an oscilloscope can be used with various comparison frequencies as suggested in Dawley's articles. A few spot frequencies that can be used for a temporary calibration are the a.c. line frequency (25, 50, or 60 cycle), the 10-kc. beat between two broadcast stations on adjacent channels, and the 440 and 1000 cycle transmissions from WWV when they are back on the air with their modulated signals.

The output, as seen on an oscilloscope, should be about as near to a sine wave as there is much use for, and the voltage output should be constant from one end of the dial to the other.

A possible refinement, shown on the diagram but not in the photographs, is a keying jack for code practice or i.c.w. modulation of a transmitter.

Considering the low price and small size of the oscillator it has been well worth the trouble of construction. The longer it graces the test-equipment shelf the more uses I find for it.

The Amateur Newcomer

[*Continued from Page 66*]

forgets to close the key. Since the circuit is in series (when you are sending to Phil, the sounders all along the line are whacking and anyone who wants to can listen to your business if he wants to), that puts the whole line out of commish until Phil is traced and told to "Hurry up and close that ?&%($§ key."

All this without Temperamental Tim. He's the one who sends sloppier code than all the rest of 'em put together, and then gets angry, nay, mad when someone breaks him to ask for a repeat.

Faith and Bedad! (This exclamation despite my obvious un-Irish ancestry.) Still, in spite of all this, thousands of messages are handled each day without error!

Code is a survival of the fittest. If you coddle yourself, you will only get it in the neck at the finish.

Really, though, Morse ops. can send good code, too. Most of them, when they get hooked up with a beginner who is particularly green, send excruciatingly slow and even, or as they put it, they "print."

Here's a famous Morse story. A Station Agent sent a message to the Superintendent, in which he said, "Foundation under platform very weak. Please advise, etc." Now, the op. who was taking this stuff was a little green, and perhaps the Agent was a little overly sloppy. Anyway, the received message said, "Found a lion under platform very weak. Please advise, etc." Needless to say, this telegram drew prompt, though perhaps skeptical, inquiries. Since in Morse, a "T" is a short dash, and an "L" is a dash slightly longer, this story is plausible. But in spite of the story, Morse ops. seldom make a mistake.

Now, how is it that Morse ops. can get almost any kind of stuff, and hams—we hams, who have so much less to contend with, must have our code sent perfect, prepaid, all wrapped up in lace and ribbon or we don't get it?

For this reason:

As far back as I can remember, and as far back as hams older than I can remember, there seemed to be an insidious campaign going on. Budding neophytes were being told of the penalties for not sending perfect code. I remember being told by one wiseacre that the poor op. who don't send good code gets a rep and no one wants to speak with him.

Result:

We immediately broke water, practiced on

an oscillator, and made tolerably good senders. Which is all very fine. But—we forgot that it *was* possible that there *could* exist a feller who didn't send perfect code.

We can't improve the other feller's sending—unless we are running a code school. We can't tell the other guy what slop he is sending unless he doesn't owe us money or isn't bigger than we.

I once heard an op. ask another feller if he were holding the key between his knees and making the characters by squeezing his knees together.

The other feller said, "Thank you, old boy. I appreciate this." Do you think he went into a corner and started practicing forthwith?

He did in a pig's eye!

I hope I've pointed out now that you can't improve the other feller. Don't even think of it, even when you are alone.

The only thing left is to improve yourself so that you get him solid, even if he's using his left foot. There's no other way.

For practice, turn to a ham band. There you will find molasses, greased-bugs, and such balderdash as will make the strongest gnash their teeth and wring their hands, provided you look for it. But don't let it get you down, chum. When you finally get 'em solid, you'll find yourself in as blissful a state of ecstasy as the day you got your ticket.

And, of course, practice on a mill. You really oughtn't call yourself an op. unless you take it on a mill. A course in touch-typing, though not absolutely necessary, lasts only a few weeks and is very desirable. If you can't touch type, you will still make a very excellent op., but it will take you at least twice as long.

New Tubes

[*Continued from Page 79*]

MAXIMUM CCS AND ICAS RATINGS WITH TYPICAL OPERATING CONDITIONS

As A.F. Amplifier and Modulator—Class B

	CCS	ICAS	
D.C. Plate Voltage (Max.)	1250	1500	Volts
Max.-Sig. D.C. Plate Current (Max.)	200	200	Ma.
Max.-Sig. Plate Input (Max.)	225	250	Watts
Plate Dissipation (Max.)	75	85	Watts

Typical Operation:

Values are for 2 tubes

	CCS	ICAS	
D.C. Plate Voltage	1250	1500	Volts
D.C. Grid Voltage	—55	—70	Volts
Peak A.F. Grid-to-Grid Volt.	290	310	Volts
Zero-Sig. D.C. Plate Current	40	40	Ma.
Max.-Sig. D.C. Plate Current	320	310	Ma.
Plate-to-Plate Load Resistance	8000	10,000	Ohms
Max.-Signal Driving Power (Approx.)	4	4	Watts
Max.-Signal Power Output (Approx.)	250	300	Watts

As Plate-Modulated R.F. Power Amplifier—Class C

	CCS	ICAS	
D.C. Plate Voltage (Max.)	1000	1250	Volts
D.C. Plate Current (Max.)	160	200	Ma.
D.C. Grid Voltage (Max.)	—200	—200	Volts
D.C. Grid Current (Max.)	45	45	Ma.
Plate Input (Max.)	160	240	Watts
Plate Dissipation (Max.)	50	75	Watts

Typical Operation:

	CCS	ICAS	
D.C. Plate Voltage	1000	1250	Volts
D.C. Grid Voltage			
Fixed Supply	—115	—130	Volts
Resistor	7000	7000	Ohms
D.C. Plate Current	160	190	Ma.
D.C. Grid Current (Approx.)	28	28	Ma.
Driving Power (Approx.)	9	9	Watts
Power Output (Approx.)	170	220	Watts

As R.F. Power Amplifier and Oscillator—Class C

	CCS	ICAS	
D.C. Plate Voltage (Max.)	1250	1500	Volts
D.C. Plate Current (Max.)	200	200	Ma.
D.C. Grid Voltage (Max.)	—200	—200	Volts
D.C. Grid Current (Max.)	45	45	Ma.
Plate Input (Max.)	240	300	Watts
Plate Dissipation (Max.)	75	85	Watts

Typical Operation:

	CCS	ICAS	
D.C. Plate Voltage	1250	1500	Volts
D.C. Grid Voltage			
Fixed Supply	—115	—130	Volts
Grid Resistor	3800	4000	Ohms
Cathode Resistor	520	560	Ohms
D.C. Plate Current	190	200	Ma.
D.C. Grid Current (Approx.)	30	32	Ma.
Driving Power (Approx.)	6.5	7.5	Watts
Power Output (Approx.)	170	220	Watts

931

The 931 is a new type of phototube in which the current produced by light falling on a light-sensitive cathode is multiplied many times by secondary emission occurring between nine successive dynodes within the tube. It is capable of multiplying the current produced by weak illumination as much as 230,000 times. The 931 is fitted with a small 11-pin base.

8001

The 8001 is a new transmitting beam tetrode suitable for power amplifier, modulator, and oscillator service. Because of its low driving power requirements and because it usually will not need neutralization, the 8001 is well suited

to all-band transmitter service. In class C telegraph service it will provide a power output of approximately 230 watts at frequencies as high as 75 Mc. Ratings and typical operating conditions are as follows:

Characteristics and Ratings

Filament Voltage	5.0 Volts
Filament Current	7.5 Amperes
Direct Interelectrode Capacitances	
Grid-Plate (with ext. shield)	0.1 μμfd.
Input	11 μμfd.
Output	5.5 μμfd.
Base	Giant 7-Pin Metal

MAXIMUM CCS RATINGS AND TYPICAL OPERATING CONDITIONS

As Suppressor-Modulated Amplifier

Typical Operation:

D.C. Plate Voltage	2000 Volts
D.C. Suppressor Voltage	—300 Volts
D.C. Screen Voltage	
Fixed Supply	500 Volts
Series Resistor	2000 Ohms
D.C. Grid Voltage	—130 Volts
Peak A.F. Suppressor Voltage	300 Volts
D.C. Plate Current	55 Ma.
D.C. Screen Current	27 Ma.
D.C. Grid Current (Approx.)	3 Ma.
Driving Power (Approx.)	0.4 Watt
Power Output	35 Watts

As Plate-Modulated R.F. Amplifier—Class C

Typical Operation:

D.C. Plate Voltage	1800 Volts
D.C. Suppressor Voltage	60 Volts
D.C. Screen Voltage	
Fixed Supply	400 Volts
Series Resistor	125,000 Ohms
D.C. Grid Voltage	
Fixed Supply	—130 Volts
Grid Resistor	16,000 Ohms
D.C. Plate Current	135 Ma.
D.C. Screen Current	11 Ma.
D.C. Grid Current (Approx.)	8 Ma.
Driving Power (Approx.)	1.7 Watts
Power Output (Approx.)	178 Watts

As Power Amplifier and Oscillator—Class C Telegraphy

Typical Operation:

D.C. Plate Voltage	2000 Volts
D.C. Suppressor Voltage	60 Volts
D.C. Screen Voltage	
Fixed Supply	500 Volts
Series Resistor	13,600 Ohms
D.C. Grid Voltage	
Fixed Supply	—200 Volts
Grid Resistor	33,000 Ohms
D.C. Plate Current	150 Ma.
D.C. Screen Current	11 Ma.
D.C. Grid Current (Approx.)	6 Ma.
Driving Power (Approx.)	1.4 Watts
Power Output (Approx.)	230 Watts

United Z-225 Rectifier

United Electronics Co. has announced a new mercury-vapor rectifier tube, the Z-225, which occupies only one half the cubic space of the 866-866A types, and yet has the same voltage and current ratings as the larger tubes. The Z-225 has a tubular bulb, and measures 1¾ inches in diameter and 5½ inches in overall height, including base prongs and plate cap. Ratings are the same as for the 866-866A.

New Hytron Beam Tetrodes

Hytronic Laboratories announce the addition of two instant-heating r.f. beam tetrodes to its line. One of these, the HY65, has about one-third the power capacity of the now widely used HY69. The HY67 has a 65-watt plate dissipation and more than twice the r.f. output of the HY69. Tentative characteristics for these tubes, which will be available shortly after July 1, are as follows:

HY65

The HY65 is supplied with an all-ceramic octal base having 6V6GTX base wiring except for the plate which is connected to a top cap. The HY65 is completely shielded for r.f. and no neutralizing is required even at its maximum frequency rating of 60 megacycles.

The HY65 is designed to replace the 6V6 and 6L6 type tubes in low-power stages and is for use also in portable and emergency type equipment. The instant-heating filament makes the HY65 particularly desirable for battery-operated transmitters where power must be conserved during stand-by periods.

MAXIMUM RATINGS AND TYPICAL OPERATION

Filament........instant-heating 6.3 volts (a.c. or d.c.)

PLATE AND SCREEN MODULATED R.F. POWER AMPLIFIER

(Carrier conditions per tube for use with maximum modulation factor of 1.0)

Maximum Ratings

D.C. plate potential	350 max. volts
D.C. screen potential	250 max. volts
D.C. grid bias	—150 max. volts
D.C. plate current	63 max. ma.
D.C. grid current	6 max. ma.
D.C. plate input	22 max. watts
Screen input	2.5 max. watts
Plate dissipation†	6.6 max. watts

†Rises to 10.0 watts when 100% modulated by audio of sine wave form.

Typical Operating Conditions

D.C. plate potential	250	350	volts
D.C. screen potential	200	200	approx. volts
D.C. grid voltage	—40	—45	approx. volts
D.C. plate current	60	63	ma.
D.C. grid current	3	3	ma.
Driving power	0.5	0.5	approx. watts
Power output	10	14	approx. watts

R.F. AMPLIFIER AND OSCILLATOR CLASS "C" TELEGRAPHY

Maximum Ratings

D.C. plate potential	450 max. volts
D.C. screen potential	250 max. volts
D.C. grid bias	—150 max. volts
D.C. plate current	63 max. ma.
D.C. grid current	6 max. ma.
D.C. plate input	28 max. watts
D.C. screen input	2.5 max. watts
Plate dissipation	10 max. watts

Typical Operating Conditions

D.C. plate potential	250	350	450	volts
D.C. screen potential	200	200	200	approx. volts
D.C. grid bias	—40	—45	—45	volts
D.C. plate current	60	60	63	ma.
D.C. grid current	3	3	3	approx. ma.
Driving power	0.5	0.5	0.5	approx. watts
Power output	10	14	19	approx. watts

The above ratings are for continuous-service operation. Audio amplifier and other modulator characteristics will appear in an early issue of RADIO.

HY67

The HY67 is an all-purpose graphite-anode r.f. beam power tetrode with rugged four-way mechanical support making the tube unusually well-suited for use in aircraft and similar applications where the equipment is subjected to extreme vibrations and mechanical shock. The r.f. shielding of the HY67 is complete and, therefore, neutralizing is not necessary.

MAXIMUM RATINGS AND TYPICAL OPERATION

Filament—instant-heating 6.3 or 12.6 volts (a.c. or d.c.)

PLATE AND SCREEN MODULATED R.F. POWER AMPLIFIER

(Carrier conditions per tube for use with maximum modulation factor of 1.0.)

Maximum Ratings

D.C. plate potential	1000 max. volts
D.C. screen potential	300 max. volts
D.C. grid bias	—300 max. volts
D.C. plate current	150 max. ma.
D.C. grid current	15 max. ma.
D.C. plate input	145 max. watts
D.C. screen input	7.5 max. watts
D.C. plate dissipation††	44 max. watts

††Rises to 65 watts when 100% modulated by audio of sine wave form.

Typical Operating Conditions

D.C. plate potential	750	1000	volts
D.C. screen potential	300	300	approx. volts
D.C. grid bias	—150	—150	approx. volts
D.C. plate current	120	145	ma.

D.C. grid current	12	14 ma.
Driving power	2	2 approx. watts
Power output	64	101 approx. watts

R.F. POWER AMPLIFIER AND OSCILLATOR—CLASS "C" TELEGRAPHY

Maximum Ratings

D.C. plate potential	1250 max. volts
D.C. screen potential	300 max. volts
D.C. grid bias	—300 max. volts
D.C. plate current	175 max. ma.
D.C. plate input	215 max. watts
D.C. screen input	10 max. watts
Plate dissipation	65 max. watts

Typical Operating Conditions

D.C. plate potential	750	1000	1250	volts
D.C. screen potential	300	300	300	approx. volts
D.C. grid bias	—60	—70	—80	approx. volts
D.C. plate current	120	150	175	ma.
D.C. grid current	10	10	10	approx. ma.
Driving power	1.4	1.4	1.5	approx. watts
Power Output	64	105	152	approx. watts

Past, Present and Prophetic

[*Continued from Page 6*]

landed in his hands. Becker promptly remailed it to us in Santa Barbara—at any rate he thought he remailed it. He actually handed it to a bell-boy to mail, and it has never been seen since. After much haggling with the post office the manuscript was given up for lost, and Paull was induced to send a carbon copy, along with several rolls of negatives of his photos. Thus it finally gets into print, though several months late. The moral? Always tip the bell-boy.

Hasta la Vista

As soon as this issue is on the presses, ye editors will retire to their individual padded cells and commence their yearly "vacation" task of producing a new "Radio" Handbook. While that chore is being done, we will, as usual, suspend publication of Radio for two months. We'll be back in September, however, and until that time please accept our best wishes for success in all your summer ventures.

Address?

Another missing address: Ed Caldicott sent us $5.00 for a three-year subscription to Radio, but forgot to give his address. Any information on the subject would be appreciated.

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There are more than three thousand licensed ship stations aboard vessels of U.S. registry.

Just Another Portable Mobile

[*Continued from Page 19*]

Procure the best switch available and choose a d.p.s.t type, paralleling the contacts. The three control wires are unimportant as to size, two being the mike line and the remaining one the relay control circuit which operates from switch to ground.

The block interconnecting wiring diagram clearly shows all units and the method of interconnection and gives a picture of the whole scheme of wires from battery to antenna. It should not be necessary to drill any holes if the cables are routed under the floor mat as shown, and no wires will be dangling under the car.

Tuning Procedure

Upon completion of the r.f. and modulator section and after the usual and normal "debugging" session using an a.c. power supply, the units should be ready to assemble in the car. A piece of thin strip copper or metal should run under both units, effectively grounding the two. This should be soldered also to the frame of the car if at all possible, making for a good r.f. ground. If one uses a quarter-wave antenna against the frame of the car, it is most important that the chassis of the r.f. section be at the same r.f. potential as the car frame.

With the transmitter filaments lighted, measure the battery voltage at a tube socket. If ok, switch on the plate and again observe the voltage. If this reading is less than 5.5 volts with a fully charged battery, steps will have to be taken to correct the trouble. Inspect and tighten all battery connections and feel for any heat developed in the wiring. Using at least No. 10 wire for the long runs from front to back of car, a minimum of 5.5 Volts with an 18-ampere drain should be obtained. In most cases with the engine running, approximately 6 volts is readily observed.

The following gadgets are useful in tuning the mobile transmitter and should be carried along as "standard equipment."

Non-metallic hex wrench, ¼" size

32-volt 15-watt Mazda bulb (used as dummy antenna)

0-100 d.c. milliammeter, equipped with a standard telephone plug and connecting leads

An absorption type wave meter to cover the 56-Mc. band, with indicating bulb.

Last, but not least by any means, should you possess a "jallopy" of the same breed as the writer's, part ownership in a filling station would be most welcome.